Science Abstracts

PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

Edited and Issued Monthly by

THE INSTITUTION OF ELECTRICAL ENGINEERS

In Association with

THE PHYSICAL SOCIETY

THE AMERICAN PHYSICAL SOCIETY

THE AMERICAN
INSTITUTE OF ELECTRICAL ENGINEERS

ABSTRACTS 3040-3273

VOLUME 49 **DECEMBER 1946** NUMBER 588

MATHEMATICS 51

512.34 : 518.5 3040

Some numerical methods for locating roots of polynomials. FRY, T. C. *Quart. Appl. Math.*, **3**, 89–105 (*July*, 1945).—A thorough discussion is given of two groups of methods. The first involves matrix iteration, and the methods of Aitken and Bernoulli and variations of these come within this category. The second group depends on Cauchy's theorem regarding the number of roots within a closed contour in the complex plane. In one method the number of roots with real parts greater than a given value is found. Repetition of the process segregates the roots within strips parallel to the imaginary axis. Then by a routine process the values of the real parts of the roots may be found; and, using these, the imaginary parts are determined at once. A machine, called the Isograph, is also described for determining the roots. This gives accuracies to about 1% and the quickest method is to use this machine first and then improve the values, if necessary, by one of the methods described in the paper. L. S. G.

518.1 : 621.317.39 3041

Computation problems in circuit design. BAKER, G. T. *P.O. Elect. Engrs' J.*, **39**, 58–63 (*July*, 1946).—Analyses certain computation processes and reproduces these in physical terms, using telephone type apparatus. The technique is illustrated by an application to time measurement problems.

518.5 : 512.34 *see Abstr.* 3040

518.5 : 621.317.39 3042

A twelve equation computing instrument. BERRY, C. E., AND PEMBERTON, J. C. *Instruments*, **19**, *Pt I*, 396–8 (*July*, 1946).—[Abstr. 2849 B (1946)].

519.241.6 3043

Representation of relative variability on a semi-logarithmic grid. MUHSAM, H. V. *Nature, Lond.*, **158**, 453 (*Sept.* 28, 1946).

ASTRONOMY . GEODESY 52

522.617.2 : 523.821.3 3044

The Fabry method of stellar photometry. REDMAN, R. O. *Mon. Not. R. Astr. Soc.*, **105** (*No.* 4) 212–24 (1945).—Experience at Pretoria in the use for photometry of the image of the telescope objective formed in the light of a selected object by an auxiliary short-focus lens near the focal plane is described. An accurate light curve of RS Sgtr obtained by this means shows an average deviation for one exposure of 0·013 mag. Continuous recording on a moving emulsion improves the photometric accuracy only on nights with a poor sky. Results obtained in checking a magnitude sequence are compared with four independent sets of magnitudes. The Fabry magnitudes show the smallest average deviation from the mean. A. HU.

522.617.2 : 523.821.3 *see Abstr.* 3055

522.982.2 : 535.313.6 *see Abstr.* 3111

523.112 : 530.12 3045

Theoretical cosmology. WALKER, A. G. *Observatory*, **66**, 285–9 (*June*, 1946).—An expanding model universe is considered in which the frequency of every absorption line, measured at the source, is constant in the t-time of generalized kinematical relativity, and the rate at which quanta of any particular wave-frequency are emitted from a nebula $\propto 1/t$, where t is measured from the instant when the universe started to expand. In the equivalent static model the wave-frequency $\propto t$ and the emission-frequency is constant. Both models are consistent and agree with the observational correlations. The argument is adapted to general relativity by using the appropriate forms of the assumptions. The observed correlations must be taken to third approximations before we can distinguish between the theories. A. HU.

523.2 : 536.422.15 *see Abstr.* 3144

523.531 3046

Derivation of meteor stream radiants by radio reflexion methods. HEY, J. S., AND STEWART, G. S. *Nature, Lond.*, **158**, 481–2 (*Oct.* 5, 1946).—Scatter echoes observed on wavelengths of 4–5 m at 150 kW peak power, using a directive aerial, were found to be correlated with passage of meteors. By inclining the aerial system on different bearings, the radiant directions could also be determined.

523.73 : 523.774 *see Abstr.* 3050

523.73 : 523.775.2 *see Abstr.* 3052

523.746 3047

Apparent visible violet radiation in the recent large sunspot group. BARTLETT, J. C., JR. *Science*, **104**, 681–2 (*June* 7, 1946).

523.752 3048

Solar prominences. BRUCE, C. E. R. *Observatory*, **66**, 263–4 (*April*, 1946).—The form, velocity of propagation, recurrence and mutual attraction of solar prominences suggest that they are electrical discharges. The mechanism of leader and return strokes is traced in coronal and surge prominences. Sunspots are regarded as regions in which the discharges are extinguished owing to the deflection of current into a neighbouring facula. A. HU.

523.755 3049

Preliminary results from measurements of polarization in the corona. ÖHMAN, Y. *Observatory*, **66**, 261–2 (*April*, 1946).—Polarigraph measures at the eclipse of July 9, 1945, show that in the inner corona the percentage polarization agrees with that expected from Thomson scattering by free electrons. In the outer corona the polarization is considerably less at all wavelengths, indicating the presence of an additional light-scattering process producing a superposed radiation, practically unpolarized. This is pro-

velocity *in situ* and of the transport velocity through the stellar material. A. HU.

529.786 : 621.396.611.21 3061

A quartz clock. BOOTH, C. F. *P.O. Elect. Engrs' J.*, **39**, 33–7 (*July*, 1946).—Discusses the development of the clock and its application in astronomy. The design and performance of representative units are outlined. The gain of a typical clock in one year in terms of an ideal clock of zero rate, would be 3·15 sec over a period of 31 536 000 sec. P. O.

PHYSICS 53

53.081.3 3062

On the theory of scales of measurement. STEVENS, S. S. *Science*, **104**, 677–80 (*June* 7, 1946).

FUNDAMENTALS 530.1

530.12 = 4 3063

On certain generalizations of change of co-ordinates. SLANSKY, S. *C.R. Acad. Sci., Paris*, **222**, 857–8 (*April* 8, 1946) *In French.*—Following up the work of Destouches on Lorentz transformations in which the coefficients may include operators as well as ordinary numbers, it is shown that the transformation formulae for these operators are deduced from the co-ordinate transformation formulae as if such operators were ordinary numbers. W. E. D.

530.12 : 523.112 *see Abstr.* 3045

530.12 : 535.337 *see Abstr.* 3115

530.145 3064

On the quantum theory of wave fields. BELINFANTE, F. J. *Physica, 's Grav.*, **7**, 765–78 (*Oct.*, 1940).—The theory of Heisenberg and Pauli is developed and the proof of the relativistic invariance of the commutation rules is treated in a more general manner in which the cases of the electromagnetic field and heavy quanta are considered. For simplicity, only first order Lagrangian operators are considered and the implications of this are discussed. This treatment considers in detail the Fermi–Dirac statistics as well as the Einstein–Bose statistics dealt with by Heisenberg and Pauli. W. E. D.

530.145 3065

New developments in relativistic quantum theory. MØLLER, C. *Nature, Lond.*, **158**, 403–6 (*Sept.* 21, 1946).—The well-known divergence difficulties of ordinary quantum theory are discussed and some of the features of Heisenberg's new method [Abstr. 2109 (1944)], the so-called "*S*-Matrix method," are described. When *S* is given, the asymptotic behaviour of the wave functions and all kinds of cross-sections are determined. *S* is a unitary Lorentz-invariant matrix. L. S. G.

530.145 = 3 3066

A problem on the theory of the deuteron. BLEULER, K. *Helv. Phys. Acta.*, **17** (*No.* 6) 405–8 (1944) *In German.*

530.145.6 : 536.48 3067

The lowest wave function of the symmetrical many particles system. BIJL, A. *Commun. K. Onnes Lab., Leiden* (*Suppl. No.* 90). *Physica, 's Grav.*, **7**, 869–86 (*Nov.*, 1940).—The general scheme of the perturbation theory, in which the perturbation in the wave function is developed in a series of powers of the perturbation parameter, leads to divergent results for the lowest symmetrical wave function in the limiting case of an infinite number of particles. This difficulty can be avoided by applying a development of the logarithm of the wave function in powers of the perturbation parameter. Using the wave function so obtained, it is shown that in the lowest state of a system of many interacting particles no density fluctuations occur. Some properties of the spectrum of energy levels of the many particles system are discussed, and a general proof is given of the existence of an "excitation energy," which is necessary to give one particle a motion relatively to the others. As a consequence, one could expect that the specific heat of liquid helium II would be expected to increase as $\exp(-a/T)$, and not with some power of T.

530.162 : 537.228.1 : 536.53 *see Abstr.* 3146

MECHANICS OF SOLIDS 531

531.19 = 3 3068

On Bose-statistics. SCHUBERT, G. *Z. Naturforsch.*, **1**, 111–20 (*March*, 1946) *In German.*—Gentile [*Nuovo Cim.*, **17** (*No.* 10) (1940)] restricted the maximum number of particles allowed to each available state to N, the total number of particles in the assembly, and gave correction terms to the usual formulae. It is proved that Gentile's method and the usual method of unrestricted numbers must give the same exact results for the partition function, either by using the symmetry properties and quantum mechanics, or by the Darwin–Fowler method. In an expansion, the Gentile terms are of order e^{-N}. Terms of order $(1/N)$ are explicitly obtained by the Darwin–Fowler method. Near absolute zero no terms can be omitted, and the mean occupation numbers and energy in this region are found from the basic definitions. G. J. K.

531.224 : 531.787 3069

Elastic behaviour of the so-called Bourdon pressure gauge. BIEZENO, C. B., AND KOCH, J. J. *Proc. Ned. Akad. Wet.*, **44** (*No.* 7) 779–86; (*No.* 8) 914–20 (1941).—A mathematical theory of the Bourdon gauge enabling deformation and stresses in the Bourdon tube to be calculated, and taking into account both the flexural stiffness of the tube wall and the so-called "flattening" of the tube as described by von Kármán [Abstr. 1 (1912)] is developed. Very high stresses are produced by relatively low pressures, and proportionality between stress and strain is violated at pressures for which the gauge is said to be designed. Hence many ruptures occur; elastic hysteresis is observed. J. S. G. T.

531.258 3070

The elastic stresses produced in a thick plate by the application of pressure to its free surfaces. SNEDDON, I. N. *Proc. Camb. Phil. Soc.*, **42**, 260–71 (*Oct.*, 1946).—The method of Hankel transforms introduced in a previous paper [Abstr. 1739 (1945)] is used to

Lond., **153** (*War Emerg. Issue No.* 9) 261–71 (1945).—[Abstr. 2796 B (1946)].

532.612.4.096 = 4 3081

Law of variation of surface tension with temperature. MEZGER, E. *C.R. Acad. Sci., Paris*, **222**, 948–50 (*April* 15, 1946) *In French.*—The surface tension of a liquid is given by the formula

$$\gamma = U_0 N^{\frac{2}{3}}(1 - \theta^2)(v^{\frac{1}{3}} - l)^{-2}$$

Here $U_0 = \beta T_c^2$, where T_c is the critical temperature and β a constant, N is Avogadro's number, θ the temperature, $v = Nr^3$ (r being the radius of the molecule), and l is a correction factor.

532.72 : 541.64 3082

Thermal migration of macromolecules. HARTLEY, G. S., AND TOMS, B. A. *Nature, Lond.*, **158**, 451 (*Sept.* 28, 1946).—Observations confirming the rapid thermal diffusion of polymer molecules are reported. Polymethyl methacrylate in 3% solution in monochlorobenzene was placed in a cell composed of two plates, 1 cm apart, held at 115°C and 14°C respectively. In 2 hours, a jelly adhered to the hot plate containing 8·8% of the polymer. The term "thermal migration" is preferred for this phenomenon.

532.74 : 541.127.2 : 541.18 = 3 3083

Properties of reversible micelle formation from the standpoint of the mass action law. LAMM, O. *Ark. Kemi Min. Geol.*, **18 A** (*No.* 2) *Paper* 9, 22 *pp.* (1944) *In German.*—The author defines micelle formation as the aggregation of molecules or ions of a substance of relatively low molecular weight, when the concentration of its solution is increased. The mathematical theory of simple micelle formation is first developed, including that of ideal-inhomogeneous micelles, and is followed by a discussion of sedimentation and diffusion (membrane and free) in relation to micelle formation of non-electrolytes. The standpoint taken is that of the mass-action law, with the intention of throwing light upon deviations from it, and, in particular, the treatment includes that of problems relating to critical concentrations for micelle formation. The particle-distribution curve of the polydisperse solution of a simple case of non-homogeneous reversible micelle formation, when it can be approximated to an ideal Gauss error-curve, remains ideal for all concentrations for which the simple laws of solution hold good. H. H. HO.

532.74 : 541.18 : 535.343.32 3084

The determination of critical concentrations for the formation of soap micelles by the spectral behaviour of pinacyanol chloride. CORRIN, M. L., KLEVENS, H. B., AND HARKINS, W. D. *J. Chem. Phys.*, **14**, 480–6 (*Aug.*, 1946).—The absorption spectrum of pinacyanol chloride in aqueous solutions of anionic soaps changes sharply to that characteristic of its solutions in organic solvents over a short range of soap concentration. This effect is attributed to the formation of micelles, in whose hydrocarbon-like layers or cores the dye is solubilized. The critical concentrations and spectral changes were determined for K laurate and myristate, alkali oleate and dilinoleate soaps, Na cetyl sulphate, K dehydroabietate.

532.74 : 541.183 3085

Structure of soap micelles indicated by X-rays and the theory of molecular orientation. I. Aqueous solutions. HARKINS, W. D., MATTOON, R. W., AND CORRIN, M. L. *J. Amer. Chem. Soc.*, **68**, 220–8 (*Feb.*, 1946).—A long spacing vacuum X-ray camera is described. Filtered X-rays pass through a window of pure Be 0·004 in thick cemented on the camera cover, then through two Pb slits, then through the cell with 0·01 in Be windows holding the soap solution, and finally register on the photographic film. The thickness of solution examined is 1·0 mm. On the theory of molecular orientation in interfaces, the X-ray diffraction photographs of not too dilute aqueous solutions of soaps reveal that there exist double layers of soap molecules with "water" layers between them. In the double layers the hydrocarbon chains are oriented toward each other, with the polar groups toward the water. In ordinary soaps the polar groups constitute a negatively charged layer whilst the water layer contains diffuse layers of positive ions, and presumably interaction of these ions give a definite thickness, related to the amount of water in the soap solution, to the water layer. Micelles are not less than four double layers thick. Layer spacing, d, of micelles can be expressed by either $d = 2l + k \log 1/c$ or $d = b - ac$, where k, a and b are consts. and c is the weight fraction of soap. On these assumptions the amount of micellar water has been calculated. Micellar layer spacings vary from 30 to 100 Å, short spacings are approximately constant at 4·5 Å for concentrations from 4·5 to 35%, and, in this direction, the structure is that of a liquid. In any group in which there is close packing the chain-to-chain distance is 5·4 Å and the area per molecule is 26·4 Å². When a hydrocarbon chain of a soap changes from the state in which it is entirely separated and surrounded by water to the state in which it is surrounded by other hydrocarbon chains there is a very large decrease in free energy, causing, it is believed, the aggregation of single soap molecules into micelles although increase in electrical energy associated with ionic charges tends to diminish this aggregation. Equimolecular solutions of potassium laurate and potassium myristate give spacings of 51·3 and 61·5 Å. The behaviour of their mixtures, and the effect of the addition of salts on the layer spacing and the intensity of the X-ray patterns are discussed. W. R. A.

532.74 : 541.183 3086

Diffraction of X-rays by aqueous solutions of hexanolamine oleate. ROSS, S., AND MCBAIN, J. W. *J. Amer. Chem. Soc.*, **68**, 296–9 (*Feb.*, 1946).—Transparent systems were examined over a range of concentration from 30 to 92% soap. All systems show a halo with the Bragg spacing of 4·5–4·6 Å and a long spacing often in two orders. When the solutions contain more than 40% soap the water haloes do not appear. These results indicate the presence of lamellar micelles in aqueous solutions of colloidal electrolytes and the micelles consist of alternate layers of soap and water giving rise to the long spacings. The systems studied included those which were (1) fluid and isotropic, (2) fluid and anisotropic, and (3) semi-solid and anisotropic. In all these systems the long spacings increase approximately linearly. It appears that the essential structure of the micelles remains unaffected throughout the concentration range and it is the changing relations of the micelles to each other that cause the variations in properties. W. R. A.

MECHANICS OF GASES 533

533.5 = 4 3087

A safety device for vacuum apparatus. SCHÉRER, M. *C.R. Acad. Sci., Paris*, **222**, 997 (*April* 24, 1946) *In French.*

533.56 : 621.385.1 = 4 3088

Evacuation of emission tubes of medium and low power. PLION, P. *Le Vide*, **1**, 71–8 (*May*, 1946) *In French.*—[Abstr. 2657 B (1946)].

ACOUSTICS . VIBRATIONS 534

534.13 = 5 3089

The equivalent circuit of a spherical vibrator. SACERDOTE, G. *Alta Frequenza*, **15**, 28–33 (*March*, 1946) *In Italian.*—The analytical expression for the specific acoustic impedance of a spherical *n*-order vibrator is derived and the equivalent electric circuit established.

534.213 3090

The velocity of dilatation and Rayleigh waves in metal bars. MCMILLEN, J. H. *J. Acoust. Soc. Amer.*, **18**, 190–9 (*July*, 1946).—Single elastic waves in rock and metal specimens, started by impact from a fast moving steel sphere, were studied by partially immersing the specimen in water and observing the body waves in the water by means of spark shadowgrams. Waves in the water were observed to come from the dilatation body wave and the Rayleigh surface-wave in the solid. The dilatation wave velocities were measured using the slope of the wave front in water; these agreed well with the velocities calculated from the elastic constants. The velocity of the first wave or pulse corresponded to the velocity of a dilatation wave in an infinite medium, while wave velocities measured when the bar was in resonant oscillation had values characteristic of a dilatation wave in a narrow bar. The measured Rayleigh surface wave velocities showed good agreement with the theory. Spark shadowgrams were also made, showing that a Rayleigh wave is produced when a dilatation wave passes through an interface at nearly normal incidence. Rayleigh waves were also observed to produce a second Rayleigh wave at a square corner, demonstrating that the Rayleigh wave has a component of displacements which is parallel to the surface.

534.222.2 3091

A determination of the wave forms and laws of propagation and dissipation of ballistic shock waves. DUMOND, J. W. M., COHEN, E. R., PANOFSKY, W. K. H., AND DEEDS, E. *J. Acoust. Soc. Amer.*, **18**, 97–118 (*July*, 1946).—Experiments to ascertain the wave forms and laws of propagation and dissipation of ballistic shock waves to large distances (80 yd) from the bullet trajectory are described. Calibres 0·30 and 0·50 in, 20 and 40 mm were studied. In every case an N-shaped wave profile was observed consisting of a sudden rise in pressure ("head discontinuity") followed by an approximately linear decline to a pressure about equally far below atmospheric, and then a second sudden return ("tail discontinuity") to atmospheric pressure. The peak amplitudes of this disturbance are found to diminish about as the inverse $\frac{3}{4}$ power of the miss-distance (perpendicular distance from the trajectory) while the period T' (measured between the discontinuous fronts) increases about as the $\frac{1}{4}$ power of the miss-distance for calibres 0·30, 0·50 and 20 mm. For 40 mm shells the amplitude decays about as the inverse 0·9 power of miss-distance over the range studied. A theory taking account of the dissipation of the N-wave energy into heat is developed to explain the observed behaviour. A method of measuring absolute N-wave amplitudes by observing the rate of change of period T' with propagation is described. The theory leads to an absolute relationship at large distances between distance, amplitude and period in which no arbitrary constants appear.

534.232 : 534.321.9 *see Abstr.* 3096

534.24/.25 : 550.341 3092

On the Stoneley-wave equation. I–II. SCHOLTE, J. G. *Proc. Ned. Akad. Wet.*, **45** (*No.* 1) 20–5; (*No.* 2) 159–64 (1942).—A plane wave meets the plane surface of separation of two infinite elastic solids and gives rise to reflected longitudinal and transverse waves and similar refracted waves. The boundary conditions lead to equations linear in the amplitudes. When the amplitude of the incident wave is equated to zero a determinantal equation, the Stoneley-wave equation, is obtained. This equation is discussed and limits are obtained for the possible range of values of its roots. The condition (on the material constants) is found in order that Stoneley waves shall be possible at the interface of the two media.

L. S. G.

534.24/.26 3093

Transmission, reflection, and guiding of an exponential pulse by a steel plate in water. II. Experiment. OSBORNE, M. F. M., AND HART, S. D. *J. Acoust. Soc. Amer.*, **18**, 170–84 (*July*, 1946).—In this paper are given the results of an experimental study of the interaction of an explosion wave with a water-backed steel plate. Data are given showing the dependence of the transmitted and reflected waves on the angle of incidence, and of the diffracted wave on position behind the plate. The plate acts as a filter, removing the high frequencies from the transmitted wave and the low frequencies from the reflected wave. The reflected wave is approximately constant in shape, or time scale, with varying angle of incidence. Its amplitude has a broad maximum at normal incidence. In addition to the reflected, transmitted and diffracted waves, waves can travel along the plate, in which case the plate acts as a wave guide. As a consequence of dispersion in the guided waves, a precursor precedes the explosion wave as it travels along the plate. The dependence of the frequency, length and amplitude of this precursor upon orientation of the plate, position and time has been determined.

534.321.3 3094

A just scale for music. JONES, A. T. *J. Acoust. Soc. Amer.*, **18**, 167–9 (*July*, 1946).

534.321.6 : 534.845.2 3095

The absorption of ultrasonic waves in benzene. QUINN, J. *J. Acoust. Soc. Amer.*, **18**, 185–9 (*July*, 1946).—The absorption was measured as a function of the temperature by means of the sonic interferometer. The frequency-free coefficient varies from $0{\cdot}66\times10^{-14}$ to $0{\cdot}85\times10^{-14}$ over the temperature

range from 7·2°C to 73·5°C. It appears that the absorption of ultrasonic waves in liquids is effected by two causes, viz. the viscosity effect deduced by Stokes, and a second effect of uncertain origin. In benzene, the second effect predominates overwhelmingly and determines the over-all temperature dependence of the absorption coefficient.

534.321.9 : 534.232 3096

Refinements in supersonic reflectoscopy. Polarized sound. FIRESTONE, F. A., AND FREDERICK, J. R. *J. Acoust. Soc. Amer.*, **18**, 200–11 (*July*, 1946).—One form of simple circuit for the generation of the short duration h.f. voltage trains used in the supersonic reflectoscope is shown. The required band width of the system, including the crystal, is discussed. Techniques for the radiation of longitudinal, shear and Rayleigh waves are set forth. Either longitudinal or shear waves can be used to establish various modes of thickness resonance through a plate for measuring velocity of propagation or thickness. Shear waves have some of the properties of polarized light, for instance, double refraction has been measured by three methods in elastically aeolotropic solids and a technique developed for the direct indication of the amount of elastic aeolotropy. By means of a quarter-wave plate, circularly polarized sound can be produced.

534.321.9 : 535.42 3097

Diffraction of light by ultra-sonic waves of very high frequencies. BHAGAVANTAM, S., AND RAO, B. R. *Nature, Lond.*, **158**, 484 (*Oct.* 5, 1946).—A 2 mm tourmaline plate with fundamental about 2 Mc/s was made to oscillate at all harmonics up to the 54th, and diffraction patterns from stationary waves maintained in a column of water were observed at almost all frequencies between 2 and 100 Mc/s. There was found to be no dispersion in distilled water between 9·5 and 92·3 Mc/s.

534.321.9 : 541.127 *see Abstr.* 3217

534.44 : 534.781 3098

The portrayal of visible speech. STEINBERG, J. C., AND FRENCH, N. R. *J. Acoust. Soc. Amer.*, **18**, 4–18 (*July*, 1946).—This paper discusses the objectives and requirements in the portrayal of visible patterns of speech from the viewpoint of their effects on the legibility of the patterns. The portrayal involves an intensity-frequency-time analysis of speech and the display of the results of the analysis to the eye. Procedures for accomplishing this are discussed in relation to information on the reading of print and on the characteristics of speech and its interpretation by the ear. Also methods of evaluating the legibility of the visible patterns are described.

534.442 : 534.781 3099

Visible speech cathode-ray translator. RIESZ, R. R., AND SCHOTT, L. *J. Acoust. Soc. Amer.*, **18**, 50–61 (*July*, 1946).—Speech analysis patterns are made visible on a special c.r.t., whose persistent-phosphor screen is a cylindrical band coaxial with the electron gun. The beam is bent through 90° by a magnetic field and moves only in a fixed vertical plane, while the c.r.t. rotates slowly about its axis, so that the patterns are visible for a second or more. The upper portion of the screen shows a spectrum analysis up to 3 500 c/s made by mechanically scanning 12 contiguous band-pass filters. The width of a band in the lower portion of the screen is controlled by the instantaneous fundamental frequency of the speech. The translator has been used in a training programme to study the readability of visible speech patterns.

534.442 : 534.781 3100

Visible speech translators with external phosphors. DUDLEY, H., AND GNIENZ, O. O., JR. *J. Acoust. Soc. Amer.*, **18**, 62–73 (*July*, 1946).—Experimental apparatus is described in which the phosphor is mounted on a moving belt or drum. Excitation is accomplished by a row of up to 16 small electric lamps at right angles to the direction of motion of the belt, each controlled by a band-pass filter of about 300 c/s width. The patterns are visible for about 1¼ sec and are quenched by red lamps when they pass out of sight. Details are given of the small "grain-of-wheat" lamps and of the electrical circuits employed.

534.62 3101

The design and construction of anechoic sound chambers. BERANEK, L. L., AND SLEEPER, H. P., JR. *J. Acoust. Soc. Amer.*, **18**, 140–50 (*July*, 1946).—Data on the performance of five different types of structures for use in echo-free (anechoic) chambers are presented. The best is shaped like a wedge and manufactured from glass fibres held together by a binding agent. When mounted in the room, the wedges are spaced out several inches from the walls, and the dihedrals of adjacent units are turned through 90°. Generalized specifications for the optimal design of structures are presented in terms of either (*a*) lowest frequency at which >99% absorption is desired or (*b*) maximum depth of treatment which may be installed in the room. The application of these specifications to two rectangular rooms is shown and inverse square law measurements performed in the two completed chambers are presented. In the larger chamber the deviations are within ±0·3 db out to 10 ft and ±1·0 db out to 30 ft from a point source of sound. In the smaller, the deviations are within ±1·0 db out to 10 ft.

534.781 : 534.44 *see Abstr.* 3098

534.781 : 534.442 *see Abstr.* 3099

534.844.3 3102

Fluctuation phenomena in room acoustics. MAA, D.-Y. *J. Acoust. Soc. Amer.*, **18**, 134–9 (*July*, 1946).—Two types of fluctuation phenomena are discussed theoretically, utilizing the concept of normal modes of aerial vibration in the room. The fluctuation noise due to the random motion of air molecules is found to be a property of air alone and independent of the room. On the other hand, the fluctuation during reverberation depends on both the room dimensions and its reverberation characteristics. Practical formulae of the magnitudes of the fluctuations are presented, which are in good agreement with previous experimental data. The ability of the blind to estimate room size with surprising accuracy is explained, and further investigations on the problem of room liveness as related to fluctuation phenomena as well as its effect on the acoustical design of a room are suggested.

534.845.2 : 534.321.6 *see Abstr.* 3095

534.862.2 : 621.395.623.4 = 5 3103

Mechanical impedance and classification of microphones. BORDONI, P. G. *Alta Frequenza*, **14**, 218–24 (*Sept.–Dec.*, 1945) *In Italian.*—[Abstr. 2686 B (1946)].

OPTICS . RADIATION . SPECTRA 535

535.12 = 4 3104

Propagation of waves in periodic systems, having regard to certain boundary conditions. MARIÉ, P. *C.R. Acad. Sci., Paris*, **222**, 1039–42 (*April* 29, 1946) *In French.*—An expression is derived for the complex transmission and reflection factors of a regular array of non-absorbing obstacles. It is shown that the result is similar to that for the attenuation of a series of oscillating circuits loosely coupled. N. C.

535.12 : 538.56 = 4 3105

On Huygens' principle. ROCARD, Y. *Onde Élect.*, **26**, 288–98 (*July*, 1946) *In French.*—In the case of longitudinal waves radiating from a point source O varying harmonically with the time, Kirchhoff's formula shows that a Huygens secondary wavelet emanating from a point P of a wave front is not spherical, but is the surface of revolution obtained by rotating the cardioid $r = \text{const} \times (1 + \cos\theta)$ about its axis, where, Q being a point on the wavelet, $\hat{OPQ} = \pi - \theta$, and $r = PQ$. Since the amplitude of the wavelet in the direction $\overrightarrow{PO}$ is zero, the forward propagation of the waves is explained. In the case of transverse electromagnetic waves, the principle is based on the Larmor–Tedone formulae in electromagnetism. As examples the author considers the radiation from an isolated element on which plane waves are falling and the radiation from a doublet placed at the focus of a parabolic mirror, with its axis perpendicular to the axis of the mirror. V. C. A. F.

535.215 : 621.383.029.5 = 4 3106

Applications of photo-cells at high frequencies. GRIVET, P. *Ann. Phys., Paris*, **17**, 72–157 (*Jan.–Feb.*, 1942) *In French.*—[Abstr. 2655 B (1946)].

535.231.2 = 4 3107

Aperture corrections for artificial black bodies, taking account of multiple internal reflections. GOUFFÉ, A. *Rev. Opt.* (*Théor. Instrum.*) **24**, 1–10 (*Jan.–March*, 1946) *In French.*—The ordinary correction formula for the size of the aperture in a black body does not take into account the internal reflections from the walls. A new formula is deduced to include this effect and the difference is calculated for various sizes and shapes of radiating enclosure and for different emissive powers of the material. The effect of the temperature gradient between the outside of the body (assumed immersed in a medium of known temperature) and the inside is examined. J. W. T. W.

535.241.44 : 628.972 3108

Inter-reflection method of pre-determining brightness and brightness-ratios. *Illum. Engng, N.Y.*, **41**, 361–85 (*May*, 1946).—[Abstr. 2754 B (1946)].

535.243 3109

True relative intensity distribution from microphotograms. NANDA, J. N. *Indian J. Phys.*, **19**, 190–201 (*Oct.*, 1945).—Hainson's test of self-consistency has been applied to a rotating wire gauze calibration method used earlier [Abstr. 455 (1946)] confirming it at least over the range 3 000–5 000 Å. The effect of finite width of the spectrograph and microphotometer slits is considered in detail; it is shown that the contours modified by finite slit width have less curvature than the true ones, though the areas under the two are equal.

535.243 : 535.33.072 = 4 *see Abstr.* 3114

535.245.22 3110

The effect of non-uniform reflectance of the interior surface of spherical photometric integrators. BUCKLEY, H. *Trans. Illum. Engng Soc., Lond.*, **11**, 167–71 (*July*, 1946).—Examines the effect of local reduction of the reflection factor of the internal coating in a sphere used for measuring the total luminous flux from lamps and fittings. Different typical states of the sphere surface are assumed and the effect on the flux measurement is calculated for sources of light having certain typical polar curves of light distribution. J. W. T. W.

535.313.6 : 522.982.2 3111

Astigmatism under the Foucault test. LINFOOT, E. H. *Mon. Not. R. Astr. Soc.*, **105** (*No.* 4) 193–9 (1945).—The diffraction theory of the knife-edge test is applied to a circular mirror suffering from astigmatism. The theory predicts the salient phenomena observed in practice, and an explicit solution is obtained for the shadow intensities corresponding to central and non-central settings of the knife-edge. Thence it is deduced that the test will detect $\frac{1}{40}$ fringe of primary astigmatism. A. HU.

535.317.25 : 535.422 : 523.842.2 3112

On the telescopic resolution of unequal binaries. TREANOR, P. J. *Observatory*, **66**, 255–8 (*April*, 1946).—An objective criterion of optical resolving power is proposed which takes into account any intensity difference between the sources to be resolved. Resolution is possible if the principal diffraction maximum of the faint source falls on such a minimum of the brighter one that the adjacent maxima are not brighter than the faint source itself. With equal sources, the rule reduces to the Rayleigh criterion. It is tested on a plot of minimum separation against magnitude difference for unequal binaries observed with over 40 telescopes: the curve defined by the criterion forms a tolerable limit to the observations. A. HU.

535.319 = 4 3113

Methods for the study of the irregularities of well polished optical surfaces. LYOT, B. *C.R. Acad. Sci., Paris*, **222**, 765–8 (*April* 1, 1946) *In French.*—Slight surface irregularities may seriously decrease the value of a lens used, e.g., for corona observations. Two methods are described for studying the lens. In the first a direct study is made of the diffracted beam by cutting out the main image with a small screen placed at the focus; a second lens then collects the scattered light and gives an image of the lens under test. In the second method a small compensator which produces a $\lambda/4$ retardation replaces the screen and interference is obtained between the direct and the scattered radiation. A second lens is again used to collect the two sets of radiation and an interference photograph of the lens under test obtained. The second method is much the more sensitive of the two. A. H.

535.33.072 : 535.243 = 4 3114

A recording photo-electric spectrometer for low illuminations. DAUVILLIER, A. *C.R. Acad. Sci., Paris*, **222**, 1042–4 (*April* 29, 1946) *In French.*—A vacuum cell is used, with a cathode of Rb on Ag, covering the range from 2 500 to 11 000 Å. The incoming light passes through a spectrograph of high dispersion (permitting the use of slits 0·3 mm wide), and the resultant spectrum is explored by the photocell, deflections being recorded on moving photographic paper. The author concludes that this method is superior to those in which light intensities are deduced from densities of photographic images. N. C.

535.337 : 530.12 3115

Possibility of observing a transverse Doppler effect. ABELSON, P. H., MASKET, A. V., AND ROSEN, N. *Phys. Rev.*, **70**, 227 (*Aug.* 1 *and* 15, 1946).—The relativistic change of wavelength of radiation emitted from moving atoms (transverse Doppler effect) is $\Delta\lambda = \lambda v^2/2c^2$ and should amount to 20 Å for the Hβ line from 4 eMV protons passing through He or some other gas at low pressure. This is not much less than the first order Doppler effect so that observation need not be critically at right angles to the beam.

535.338.1 : 537.531 *see Abstr.* 3158

535.338.332 3116

On the hyper-fine structure and analysis of the complex line λ3842·82 $sp^3{}^3D_3$–$5p$. $^3P_2$ in the first spark spectrum of arsenic in the ultra-violet region. MUKERJI, S. K. *Indian J. Phys.*, **19**, 180–4 (*Oct.*, 1945).—This line was observed as a well resolved quartet with a coarse structure, the components degrading in intensity to the violet. These components are at intervals of 298, 278 and 162. The predicted, graphical, resultant and observed patterns are shown diagrammatically and compared. The resultant and observed patterns show fairly good agreement. The analysis was made using the graphical method of Fisher and Goudsmit [Abstr. 3092 (1931)] and assuming the nuclear spin of As to be 3/2 [Abstr. 4049 (1937)].

535.338.4 3117

High pressure carbon bands and their relation to the Swan system. SINGH, N. L. *Indian J. Phys.*, **19**, 167–79 (*Oct.*, 1945).—The suggestion that the high pressure carbon bands do not form a new electronic system but belong to the $v' = 6$ progression of the Swan system is examined in detail. It is shown that available data on these bands do not prove this suggestion. A complete rotational analysis of the bands is expected to decide the point unequivocally and show whether the bands are instances for the proposed phenomenon of inverse induced predissociation.

535.338.4 3118

Homogeneous perturbations in band spectrum of AgH molecule. SCHMID, R. F., AND GERÖ, L. *Phys. Rev.*, **70**, 226–7 (*Aug.* 1 *and* 15, 1946).

535.341 : 537.312.62 3119

Transmission of light by superconducting lead films. WEXLER, A. *Phys. Rev.*, **70**, 219–20 (*Aug.* 1 *and* 15, 1946).—The films were evaporated on to quartz plates and were micro-granular in structure. No change in absorption or spectrum was observed when the film became superconducting.

535.343 : 541.651 3120

Absorption spectra of some 2,4-dinitrophenylhydrazones. ROBERTS, J. D., AND GREEN, C. *J. Amer. Chem. Soc.*, **68**, 214–16 (*Feb.*, 1946).—The absorption spectra of twenty 2,4-dinitrophenylhydrazones were measured and the results correlated with the structures of the parent carbonyl compounds. In general the effects of the substitution of alkyl groups on the spectra of the hydrazones are much less than those observed with the corresponding carbonyl compounds. W. R. A.

535.343 : 541.651–31 3121

The ultraviolet absorption spectra of dioxadiene and dioxene. PICKETT, L. W., AND SHEFFIELD, E. *J. Amer. Chem. Soc.*, **68**, 216–20 (*Feb.*, 1946).—The ultraviolet absorption spectra of dioxene and dioxadiene have been measured up to wave numbers of 62 000 cm^{-1}. Dioxene shows low intensity absorption in the longer wavelength region followed by a steep rise to a stepout at 43 000 cm^{-1}, and there is another sharp increase near 50 000 cm^{-1} where there are three diffuse bands. The spectrum of dioxadiene contrasts sharply with that of 1,4-*cyclo*hexadiene and the first broad stepout is of lower frequency and greater intensity. There is a band at 40 000 cm^{-1} which corresponds rather with the more intense band of 1,3-*cyclo*hexadiene. Five separate band systems have been observed for dioxadiene and the vibrational separations have been measured. Possible interpretations of the data are given on the basis of the symmetry of the molecule. W. R. A.

535.343.32 3122

The absorption spectra of the negative ions of two diaminotriphenylmethane dyes. TOLBERT, B. M., AND BRANCH, G. E. K. *J. Amer. Chem. Soc.*, **68**, 315–19 (*Feb.*, 1946).—The absorption spectra of the quinoidal negative ions of viridine green and 3,3′-dicarbazylphenylmethyl chloride have been measured in acetone solution. Both compounds show a strong band ~700 mμ, the carbazyl derivative at 727 mμ and the viridine green at 704 mμ. The carbazyl dye yields a weak band at 430 mμ but in the case of viridine green, the band due to the anhydro base could never be reduced sufficiently to allow observation of any band in its neighbourhood which is at 460 mμ. The extinction coefficient of the *y*-band in the carbazyl dye is rather small and its separation from the *x*-band large: $\nu_y - \nu_x = 9\,500$ cm^{-1}. The relative instability of the quinoidal negative ions compared with that of the quinoidal positive ions is discussed. W. R. A.

535.343.32 : 541.18 : 532.74 *see Abstr.* 3084

535.343.32 = 5 3123

Effect of the dipole moment of the solvent on the absorption spectrum of solutions of iodine. LOVERA, G., AND ANGLESIO, G. *Ric. Sci. Ricostruz.*, **16**, 328–30 (*March–April*, 1946) *In Italian.*

535.343.4–14 : 538.569.4 : 539.13 3124

The inversion spectrum of ammonia. GOOD, W. E. *Phys. Rev.*, **70**, 213–18 (*Aug.* 1 *and* 15, 1946).—[See Abstr. 2305 (1946)].

535.345.6–15 3125

Near infra-red transmitting filters. BLOUT, E. R., AMON, W. F., JR., SHEPHERD, R. G., JR., THOMAS, A., WEST, C. D., AND LAND, E. H. *J. Opt. Soc. Amer.*, **36**, 460–4 (*Aug.*, 1946).—Describes filters of dyed

plastic, laminated with glass, which have no transmission in the visible spectrum but high transmission in the near infra-red, e.g. between 1 and 3 μ. Several such filters with maximum transmissions up to 80% have been developed, some with zero transmission at wavelengths longer than 3 μ as well as in the visible. J. W. T. W.

535.36.2 : 676 3126

Light scattering and absorption coefficients from reflectance data. CAMPBELL, W. B., AND BENNY, J. *Pulp Pap. Mag. Can.*, **47**, 74–8 (*June*, 1946).—The optical scattering (S) and light absorption (K) coefficients of a sheet of paper determine its optical properties, and are dependent mainly on the structure of the sheet and on the chemical composition of the materials comprising it, respectively. Kubelka–Munk curves relating the reflectances of a pile of sheets so thick that no light is transmitted (R), and of a single sheet backed by a perfect black (R') are given; from these, S may be determined. K is thence obtained with the aid of further curves (also given) relating K/S and R. With coloured papers R and R' must be determined for a series of wavelengths, and reflectance curves (obtained with a Hardy spectrophotometer) drawn. J. G.

535.37 : 621.327.43(43) 3127

German fluorescent lamp industry and phosphor chemical manufacture. *BIOS Rep.* (*No.* 395) (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 35 *pp.* (1946).—[Abstr. 2635 B (1946)].

535.37 : 621.396.96 : 621.385.832 3128

Luminescence and tenebrescence as applied in radar. LEVERENZ, H. W. *RCA Rev.*, **7**, 199–239 (*June*, 1946).—Describes the screen luminescence requirements in radar scanning tubes, and shows how far these can be met by the use of special materials. The principal development noted is the use of "cascade" screens in which multiple layers of different phosphors are used to give increased phosphorescence (adjustable to anything from 1 to 30 sec) with reduced initial luminescence. Attempts have been made to provide a screen giving dark traces on a bright field by using either negative modulation of luminescence or the "tenebrescence" of a material showing absorption under bombardment (scotophor). J. W. T. W.

535.371 3129

Decay of zinc sulphide type phosphors. KLASENS, H. A., AND WISE, M. E. *Nature, Lond.*, **158**, 483–4 (*Oct.* 5, 1946).—Luminescence intensities are calculated over the whole decay period, assuming retrapping of electrons, for the simplest case of one type of luminescent centre. Some typical examples are given in figures representing decay curves for different initial intensities and temperatures.

535.372 : 577.1 3130

Fluorescence fatigue. ALPER, T. *Nature, Lond.*, **158**, 451 (*Sept.* 28, 1946).—The fluorescence of biological substances (e.g. vitamin A, riboflavin) has been found to decay exponentially under constant illumination to an indefinitely low value. The fluorescent assay of these substances thus depends on previous treatment.

535.375.5 : 542.958.1 3131

Spectroscopic identification of the nitronium ion. INGOLD, C. K., MILLEN, D. J., AND POOLE, H. G. *Nature, Lond.*, **158**, 480–1 (*Oct.* 5, 1946).—The Raman spectrum of mixtures of nitric and sulphuric acids always shows two lines, at 1 050 and 1 400 cm^{-1}, whose source, if it is common to them both, cannot be NO_2^+, which can only give a single line. The 1 400 cm^{-1} line has now been obtained alone from a mixture of nitric and perchloric or selenic acids, so that its source is either a diatomic or a linear, symmetrical, triatomic molecule. It is identified with $O = \overset{+}{N} = O$.

535.375.5 : 548.0 3132

Raman spectra of the second order in crystals. III. Quartz. KRISHNAN, R. S. *Proc. Indian Acad. Sci. A*, **22**, 329–42 (*Nov.*, 1945).—Using λ2536·5 mercury line as exciting radiation a study of the Raman effect in quartz has been made and 43 lines recorded, about half for the first time. The frequency shifts of 14 of these lines, including 2 doublets, have been accurately measured and are attributed to the internal oscillation spectrum of the unit cell of the quartz lattice. Seventeen of the remaining lines have been satisfactorily explained as octaves and combinations of some of the principal frequencies, and the remaining 12 constitute in part the super-lattice spectrum of quartz. On the assumption that the vibration spectrum consists of 16 principal frequencies, 12 appearing in the Raman and 4 in the infra-red absorption spectrum, the specific heat of quartz has been evaluated. The calculated values of the specific heat were less than the observed values over the temperature range 25·8–803°K. Neglect of the super-lattice frequencies is responsible for the discrepancies. The Brillouin components due to longitudinal sound waves in quartz have been photographed using an aluminized Fabry–Perot etalon, and the dependence on crystal orientation of the form of the interference pattern has been qualitatively explained. W. R. A.

535.375.5 : 548.0 3133

Raman spectra of the second order in crystals. IV. Barytes. KRISHNAN, R. S. *Proc. Indian Acad. Sci. A*, **23**, 288–95 (*May*, 1946).—The Raman effect in natural crystals of barytes has been studied in detail using the 2 536·5 Å Hg line as exciting radiation. The spectrum consists of 39 Raman lines, 20 belonging to the 1st order (9 lattice lines and 11 lines due to internal oscillations of the SO_4'' ion) and 19 to the 2nd order. The appearance of 11 lines in the 1st order spectrum of the SO_4'' ion is attributed to the lower order of symmetry of barytes crystals and to Fermi resonance splitting. The 2nd order lines have been assigned as octaves and combinations of some of the 1st order lines. The Raman frequencies are compared with the maxima observed in the infra-red spectrum of barytes. W. R. A.

535.39 3134

Optical methods of studying films on reflecting bases depending on polarization and interference phenomena. WINTERBOTTOM, A. B. *Trans. Faraday Soc.*, **42**, 487–95 (*June–July*, 1946).—The optics of metals and of film-covered surfaces is discussed and a description given of the techniques employed in polarimetric investigations. A detailed account is also given of the methods of computing thickness/reflectivity curves and interference thicknesses based on strict film optics. A. H.

535.417 : 535.822.9 : 620.179.6 3135

Interference microscope for testing surfaces. *Industr. Diamond Rev.*, **6**, 276–9 (*Sept.*, 1946).—[Abstr. 2788 B (1946)].

535.417 : 620.179.6 = 397 3136

Plane-parallel glass indicators and technical interferometers. VOGL, J. G. *Tekn. Tidskr.*, **76**, 657–64 (*June* 29, 1946) *In Swedish.*—The principle of measurement of surface irregularities with interference by means of a plane-parallel glass plate is explained in detail and the contour mapping of the surface is described. Usual interferometers, including the Twyman–Michelson instrument, are described and various applications are explained, with illustrations. J. A. W.

535.42 : 534.321.9 *see Abstr.* 3097

535.422 : 523.842.2 : 535.317.25 *see Abstr.* 3112

535.525 : 548.0 = 5 *see Abstr.* 3235

535.642 3137

On the two accessories of three-dimensional colorimetry. I. The probable error of colorimetric tensor components as derived from a number of color matchings. II. The determination of the principal colorimetric axes at any point of the color threefold. SILBERSTEIN, L. *J. Opt. Soc. Amer.*, **36**, 464–8 (*Aug.*, 1946).

535.653.85 3138

The Munsell colour system. NICKERSON, D. *Illum. Engng, N.Y.*, **41**, 549–60 (*July*, 1946).—Describes the Munsell system of colour notation. Any colour can be specified by a code of a letter or pair of letters (indicating the five colours and their intermediates), preceded by a number giving a further grading of intermediate hues and followed by two numbers indicating respectively the "value" (lightness) and the "chroma" (saturation). The relation of this system to the ordinary trichromatic system of colour nomenclature is indicated. J. W. T. W.

535.66 3139

Use of a constant-hue flickering filter to distinguish poor imitation from real green foliage. SHURCLIFF, W. A., AND STEARNS, E. I. *J. Opt. Soc. Amer.*, **36**, 478–80 (*Aug.*, 1946).—Chlorophyll has a much higher reflection factor in the near infra-red than many imitation green pigments. The paper describes two red filters which have the same transmission for foliage but very different transmissions for the pigments. If these are alternated at about ½ sec intervals between the eyes and a scene, real foliage can be easily distinguished from camouflage because the latter alters tone markedly at each alternation. An instrument embodying this principle is described and its limitations are stated. J. W. T. W.

535.8 : 771.351 *see Abstr.* 3269

535.822.9 : 620.179.6 : 535.417 *see Abstr.* 3135

535.88 3140

Optics of searchlight illumination. HULBURT, E. O. *J. Opt. Soc. Amer.*, **36**, 483–91 (*Aug.*, 1946).—Examines, both experimentally and theoretically, the effect on the visibility of a target in a searchlight beam of (*a*) the portion of the beam which illuminates the target, (*b*) the distance between the observer and the projector, (*c*) the power of the light, and (*d*) the degree of haze in the atmosphere. The experimental work was done on 24 in and 60 in searchlights. J. W. T. W.

535.88 : 620.179.1 3141

The application of projection to inspection. HOLDEN, S. W. *Engl. Elect. J.*, **10**, 264–7 (*Aug.*, 1946).—[Abstr. 2518 B (1946)].

535.88 : 778.55 = 4 *see Abstr.* 3273

HEAT . THERMODYNAMICS 536

536.222 : 536.48 3142

New measurements on the heat conductivity of liquid helium II. KEESOM, W. H., SARIS, B. F., AND MEYER, L. *Commun. K. Onnes Lab., Leiden* (*No.* 260*a*). *Physica, 's Grav.*, **7**, 817–30 (*Nov.*, 1940).—The authors examined the way in which the heat conductivity of liquid helium II, under a pressure of about 20 cm Hg, depends on the temperature and on the intensity of the heat current, between 1·05°K and the λ-point. Below 1·6° K the conducted heat is proportional to the cross-section and the conductivity is independent of the length of the capillary tube, the temperature gradient being kept constant. The heat current density is proportional to the fifth power of the temperature, and proportional to the third root of the temperature gradient. If ϕ is the heat current density (per cm²), for this temperature region $\phi = 0{\cdot}623T^5(\partial T/\partial l)^{-\frac{1}{3}}$. Above 1·6°K the conducted heat shows a slight deviation from proportionality to the cross-section. As a function of temperature the heat conductivity has for all temperature gradients a maximum at 1·92°K, as found earlier.

536.42 = 3 3143

Results of low temperature research. II. The equilibrium diagram of HBr–DBr. CLUSIUS, K. *Z. Naturforsch.*, **1**, 142–5 (*March*, 1946) *In German.*—Solid DBr has two transformation points and HBr three, the extra transformation arising from the "splitting" of the highest transformation (at 120·26°A) into two at 113·62°A and 116·86°A respectively. The additional phase is called the *E*-phase. By working with a series of mixed crystals it was found that the temperature range of existence of the *E*-phase in HBr decreases from 3·24° at 0% DBr to zero at 47%. The phenomenon is a typical quantum effect connected with the large alteration in moment of inertia produced by the substitution of D for H. The experimental data were obtained by calorimetric measurements and by optical methods previously described [Abstr. 3844 (1937)]. L. G. C.

536.422.15 : 523.2 3144

The vapour pressures of planetary constituents at low temperatures and their bearing on the question of the origin of the planets. PARSON, A. L. *Mon. Not. R. Astr. Soc.*, **105** (*No.* 4) 244–5 (1945).—The Trouton rule and the Clausius–Clapeyron equation are used to estimate vapour pressures for Fe at temperatures far below its boiling point. Change-of-state condensation from gases is shown to have been possible for Fe and more easily condensed substances under all reasonably conceivable conditions of temperature and density at the birth of the planets, so that gravitational assistance is not necessary at the beginning. A. HU.

536.48 : 530.145.6 *see Abstr.* 3067

536.48 : 536.222 *see Abstr.* 3142

536.5 : 531.787 : 621.182.27 3145

Measuring and controlling temperature and pressure. *Power*, **90**, 65–94 (*April*, 1946).—[Abstr. 2531 B (1946)].

536.53 : 530.162 : 537.228.1 3146

On the possible use of Brownian motion for low temperature thermometry. LAWSON, A. W., AND LONG, E. A. *Phys. Rev.*, **70**, 220–1 (*Aug.* 1 *and* 15, 1946).—It is theoretically possible to measure temperatures down to 0·01°K by measuring the Johnson noise of 10^9 ohms with an electrometer tube and amplifier, but practical difficulties are likely to be considerable. An alternative is proposed in the form of a quartz bar, the fluctuations of voltage appearing across the ends in virtue of the piezo-electric properties being measured in the same way. Such a bar should have a $Q > 10^4$, and by integrating the noise over a few seconds it should be possible to measure temperatures of the order of 0·001°K.

536.63 : 536.75 3147

Specific heats at low temperatures of TiO, Ti_2O_3, Ti_3O_5, and TiN. SHOMATE, C. H. *J. Amer. Chem. Soc.*, **68**, 310–12 (*Feb.*, 1946).—Specific heats have been measured from 53° to 298°K, only Ti_2O_3 showing a "hump" with maximum at 242°K and having 0·015 excess entropy units associated with it. Molal entropies at 298·16°K are: TiO, $8·31 \pm 0·04$; Ti_2O_3, $18·83 \pm 0·06$; Ti_3O_5, $30·92 \pm 0·10$; TiN, $7·20 \pm 0·04$. W. R. A.

536.68 : 621.791 = 3 3148

Welding thermal efficiency. MATTING, A. *Elektroschweissung*, **14**, 129–34 (*Oct.*, 1943) *In German.*—[Abstr. 2739 B (1946)].

536.71 : 621.43.016.7 = 4 3149

Uni-dimensional theory of furnace-tuyères. ROY, M. *C.R. Acad. Sci., Paris*, **222**, 835–8 (*April* 8, 1946) *In French.*—The thermodynamic theory of the discharge and combustion of fuel — gasiform or pulverized, of negligible viscosity and conductivity, and homogeneous — through and at a furnace tuyère is briefly discussed. J. S. G. T.

536.75 : 536.63 *see Abstr.* 3147

536.75 : 541.183.1 *see Abstr.* 3222

536.752 3150

New temperature—total heat—entropy chart for gases with variable specific heats. FINNIECOME, J. R. *Metrop.-Vick. Gaz.*, **21**, 222–6 (*July*, 1946).—The chart was prepared for investigating the performance of gas turbine plants operating on the constant-pressure cycle, and gives thermodynamic values in ft. lb.°F units based on current knowledge of the variable sp. heats of gases at constant pressure. Entropy for adiabatic expansion in the gas turbine, total heat at any point in the cycle and adiabatic heat drops in the compressor, may be determined. M.-V.

ELECTRICITY . MAGNETISM . X-RAYS CHARGED PARTICLES 537/538

537.132 : 537.533.74 *see Abstr.* 3161

537.226.8 : 537.525 : 621.3.011.5 : 621.315.615 = 3 3151

Gas discharge effects on dielectric liquids. RUMMEL, T. *Wiss. Veröff. Siemens-Werk.*, 278–317 (1940) *Werkstoff-Sonderh. In German.*—[Abstr. 2566 B (1946)].

537.228.1 : 530.162 : 536.53 *see Abstr.* 3146

537.228.1 : 548.0 3152

ADP and KDP crystals. MASON, W. P. *Bell Lab. Rec.*, **24**, 257–60 (*July*, 1946).—Briefly discusses the piezo-electric properties of ADP (ammonium dihydrogen phosphate) and KDP (potassium dihydrogen phosphate) with particular reference to the atomic arrangement and its bearing on the ferro-electric property of KDP at −151°C. ADP shows no ferro-electric property but has a much larger piezo-electric coupling coefficient than KDP at normal temperatures, on account of slight differences in atomic structure. P. O.

537.311.31 3153

The resistance of gold amalgams in solid and liquid state between −78° and +100°C. CLAY, J. *Physica, 's Grav.*, **7**, 838–44 (*Nov.*, 1940).—In the liquid state, the addition of Au or Ag to Hg increases the conductivity by an amount proportional to the concentration, when small, and rising with temperature. In the solid state, the conductivity decreases with concentration, and is independent of temperature.

537.312 + 537.323 = 3 3154

The effect of gases, particularly traces of oxygen, on the electrical properties of vaporized PbS layers. HINTENBERGER, H. *Z. Naturforsch.*, **1**, 13–17 (*Jan.*, 1946) *In German.*—The effect of N, A, air, O and H on the electrical conductivity and thermoelectric force of PbS layers was investigated. N and A were found to produce no effect whatever, but both air and small amounts of O have a marked effect. If a highly conductive over-leaded PbS layer, vaporized in vacuo, is subjected to air at room temperature, the conductivity falls rapidly, while a feebly conducting layer of approximately stoichiometric composition shows a slight increase. The effect on over-leaded PbS layers of very small amounts of O is even more pronounced. As O is gradually admitted to the chamber, held at about 200°C, a certain amount is absorbed and the conductivity falls rapidly to a minimum value, the thermoelectric force remaining negative. With further admission of O, the conductivity slowly rises again and the thermoelectric force becomes positive. Pumping out the O does not restore the initial conductivity, but this can be regained by treatment at a high temperature (350°C) or by tempering in vacuo for about 10 hours. Conductivity measurements are in all cases made at room temperature after cooling. The effect of O is qualitatively the same as is produced by treatment with S. Tempering over-leaded PbS layers for about 30 min in H produces an increase in the conductivity, which remains after pumping out the H, but the sensitivity of such layers is considerably less than that of layers treated with traces of O. A. W.

537.312.5 : 541.135.85 *see Abstr.* 3220

537.312.62 3155

On the variation with temperature of the surface layer of superconducting mercury. CASIMIR, H. B. G. *Commun. K. Onnes Lab., Leiden* (*No.* 261*e*). *Physica, 's Grav.*, **7**, 887–96 (*Nov.*, 1940).—A method is

described which makes it possible to investigate whether for superconducting Hg in bulk the penetration depth of a magnetic field shows a variation with temperature. It is found that such a change—if it exists—must be much smaller than that derived from earlier experiments [Abstr. 4134 (1939), 1630 (1940)].

537.312.62 3156

Conductivity of sodium-ammonia solutions. DAUNT, J. G., DÉSIRANT, M., MENDELSSOHN, K., AND BIRCH, A. J. *Phys. Rev.*, **70**, 219 (*Aug.* 1 *and* 15, 1946).—Ogg's observation [Abstr. 1894 (1946)] of much lower resistance on freezing has been confirmed but no super-conducting effects have been observed. It is suggested that the magnetic moment observed by Ogg was not due to a persistent current, but to paramagnetic regions unable to reorientate on switching off the magnetic field, because of the freezing.

537.312.62 : 535.341 *see Abstr.* 3119

537.323 + 537.312 = 3 *see Abstr.* 3154

537.523.74 : 621.385.18 3157

Production of high-frequency energy by an ionized gas. THONEMANN, P. C., AND KING, R. B. *Nature, Lond.*, **158**, 414 (*Sept.* 21, 1946).—[Abstr. 2887 B (1946)].

537.525 : 621.3.011.5 : 621.315.615 : 537.226.8 = 3 *see Abstr.* 3151

537.531 : 535.338.1 3158

The relative intensity of the L_{β_2} X-ray line of various elements. DE LANGEN, K. W. *Physica, 's Grav.*, **7**, 845–8 (*Nov.*, 1940).—The intensity relative to L_{β_1} was determined for the elements Ag^{47}, Ce^{58}, Tb^{65}, Dy^{66}, Yb^{70}, Os^{76}, Au^{79} and Hg^{80} by a photographic method. For the rare-earth metals the sum of the intensities of L_{β_2} and its long wavelength satellite $L_{\beta_{14}}$ is equal to the normal intensity of L_{β_2} for those neighbouring elements that do not show the multiplet splitting of the L_{β_2}-line.

537.533.7 : 621.385.822.3 = 5 3159

Two modifications of the induction accelerator (betatron). AMALDI, E., AND FERRETTI, B. *Nuovo Cim.*, **3**, 22–39 (*Feb.*, 1946) *In Italian.*—[Abstr. 2667 B (1946)].

537.533.72 : 539.165.08 3160

On a photographic method for investigating the optical properties of magnetic lenses and for recording β-ray lines. SLÄTIS, H. *Ark. Mat. Astr. Fys.*, **32 A** (*No.* 4) *Paper* 20, 27 *pp.* (1946).—By using an annular preparation coaxial with the magnetic lens, hyperboloid arcs are obtained from the continuous β-spectrum on an axially placed photographic plate. On these arcs the β-ray lines due to internal conversion produce darker areas and thus a line-spectrum. Using formulae for the focal length of a magnetic lens [Abstr. 2450 (1944)] and the geometry of the hyperboloid arcs, the aberration caused by the half-value width of the lens is computed. The formulae are applied to the results of measurements of a plate with the spectrum of Th B + C + C″ and a value is obtained for the half width. Monochromatic β-radiation generates blacking curves on the plate and the shape of these curves is explained. Formulae are deduced for computing the energy of the β-radiation from the intersection of these blacking curves with the hyperboloid arcs. The dispersion and resolving power are computed. The theory is tested on the F-, G-, H-, I- and J-lines of the spectrum from Th B + C + C″.

L. S. G.

537.533.74 : 537.132 3161

Single scattering and annihilation of positrons. Ho, Z.-W. *Phys. Rev.*, **70**, 224–5 (*Aug.* 1 *and* 15, 1946). *C.R. Acad. Sci., Paris*, **222**, 1168 (*May* 13, 1946).—Cloud chamber photographs were obtained of 178 collisions of positrons from $_{25}Mn^{52}$ with electrons, in which the recoil and scattered tracks could be distinguished by the curvature in a magnetic field. Energy is reported to be conserved and the scattering frequency/energy transfer curve conforms roughly to Bhabha's theoretical shape [Abstr. 1849 (1936)] except that there are substantially more large angle deflections than predicted (energy transfer >70%). These would correspond to a distance of approach < classical radius of the electron. Three cases of annihilation of positrons within the chamber were observed, for a total of 240 m of β^+ tracks which agrees well with Bethe's calculation [Abstr. 2538 (1935)].

537.533.8 3162

Calorimetric experiment on the radiation losses of 2-Mev electrons. BUECHNER, W. W., AND VAN DE GRAAFF, R. J. *Phys. Rev.*, **70**, 174–7 (*Aug.* 1 *and* 15, 1946).—Various investigators report from cloud-chamber experiments that the energy lost in the scattering of 2 eMV β-rays is several times the loss calculated from the Bethe–Heitler theory. However, other experimenters have found that the production of X-rays in this range agrees with theory. To account for the extra energy loss, the emission of neutrinos has been suggested. To test this hypothesis, a 2 eMV beam of electrons was directed on a target immersed in Hg, the assembly acting as a calorimeter. Experiments using Be, Au and Hg targets show that within the experimental error (<1%) no energy is carried out of the calorimeter by neutrinos or other penetrating radiation. It thus appears that the production of such radiations cannot account for the large extra energy losses reported from cloud-chamber experiments.

537.533.8 : 621.396.615.141.2 : 621.385.16.029 = 82 3163

Secondary emission in magnetron generators. BRAUDE, S. J., AND OSTROVSKY, I. E. *Bull. Acad. Sci. URSS, Sér. Phys.*, **10** (*No.* 1) 65–74 (1946) *In Russian.*—[Abstr. 2885 B (1946)].

537.545.2 : 621.385.3.032.24 3164

The effect of grid-support wires on focusing cathode emission. YEH, C. *Proc. Inst. Radio Engrs, N.Y. Wav. Electrons*, **34**, 444–7 (*July*, 1946).—[Abstr. 2664 B (1946)].

537.565 3165

Volt-ampere characteristics for the flow of ions or electrons between concentric cylinders in gases at atmospheric pressure. RICE, C. W. *Phys. Rev.*, **70**, 228–9 (*Aug.* 1 *and* 15, 1946).—The method of J. J. Thomson is applied to concentric cylinders and equations derived. Solutions for 3 different conditions are given. Experimental observations have been found to agree with these theoretical expressions.

537.568 : 539.166.92 3166

Ionisation by gamma-rays in gases at high pressures. CLAY, J., AND KWIESER, M. *Physica, 's Grav.*, **7**,

721–36 (*Oct.*, 1940).—The cluster and columnar theories of ionic recombination are discussed. The authors do not accept the criticism by Kara–Michailova and Lea [Abstr. 513 (1940)] of the application of the columnar theory to γ-rays, and conclude that the best method of correcting for recombination is to apply the Jaffé–Zanstra extrapolation [Abstr. 4339 (1935)] to measurements with strong collecting fields. D. E. L.

537.583 : 621.385.13.032.216 : 548.73 *see Abstr.* 3239

537.591.1 3167

On the production of penetrating ionizing particles by the non-ionizing component of cosmic radiation. DE VOS, P. J. G., AND DU TOIT, S. J. *Phys. Rev.*, **70**, 229–30 (*Aug.* 1 *and* 15, 1946).—The coincidence rate of 3 vertically arranged counters was unaffected by moving a Pb absorber from above the top counter to between the bottom two. The rate was, however, significantly decreased when a rather thinner paraffin sheet was moved from above the top counter to between the top two. It is suggested that the neutral component might be fast neutrons, and the penetrating secondaries mesotrons or even protons.

537.591.15 3168

Successive multiple production of penetrating particles. FRETTER, W. B., AND HAZEN, W. E. *Phys. Rev.*, **70**, 230–1 (*Aug.* 1 *and* 15, 1946).—With a counter-controlled cloud chamber containing 8 horizontal Pb plates, and surmounted by a 30 cm Pb block, 11 photographs showing penetrating particle showers were obtained. One of these (here published) showed 3 separate and successive centres, probably in cascade, from each of which penetrating particles were emitted.

537.591.2 3169

The power spectrum of the cosmic-ray cascade component. NEY, E. P. *Phys. Rev.*, **70**, 221–2 (*Aug.* 1 *and* 15, 1946).—Several components of the cosmic radiation have been shown to follow at their point of origin a power law of the form $F(E) = \text{const.}\ E^{-1\cdot8}$, where $F(E)$ is the number of the particles of energy greater than E. If one assumes that the cascade component at distance l of electrons and of quanta can be given by expressions with the form $F(E, l) = F(l)E^{-s}$ it can be shown, if the energy content of the cascade as a whole is assumed not to be infinite, that $1 < s < 2$.

537.591.2 3170

Momentum spectrum of mesons at sea-level. WILSON, J. G. *Nature, Lond.*, **158**, 414–15 (*Sept.* 21, 1946).—The spectrum is reported in table and diagram for the momentum range $0{\cdot}025 \times 10^9$ to $2{\cdot}5 \times 10^9$ *ev/c*, obtained from cloud chamber tracks. The spectrum was normalized to the main high momentum spectrum ($p > 10^9$ *ev/c*), confirming the figures of Blackett [Abstr. 1635 (1937)] and Jones [Abstr. 741 (1940)] except for the large number of particles with $p > 10^{10}$ reported by Jones. The peak appears to fall between $0{\cdot}5$ and $1{\cdot}0 \times 10^9$ *ev/c*.

537.591.2 3171

Interpretation of the meson spectrum near sea-level. JANOSSY, L., AND WILSON, J. G. *Nature, Lond.*, **158**, 450–1 (*Sept.* 28, 1946).—The spectrum of the mesons near their place of production can be deduced from the observed sea-level spectrum, and the formulae for this are given. The experimental observations [Abstr. 3170 (1946)] indicate a spectrum at source of the form $S_0(p) \sim p^{-3\cdot3}$, where p is the momentum.

537.591.5 3172

A lunar effect on cosmic rays? DUPERIER, A. *Nature, Lond.*, **157**, 296 (*March* 9, 1946).—Analysis of hourly records of cosmic rays taken over a period of 3 years reveals a lunar semi-diurnal intensity variation, in addition to the solar semi-diurnal effect, of amplitude $0{\cdot}023\%$ of the mean. This is attributed to vertical oscillation of the meson-producing layer by an amount $\frac{1}{8}$ of the corresponding solar oscillation. The lunar tide, however, increases more rapidly with height than the solar tide.

537.591.5 3173

Solar and lunar effects on cosmic rays. KIDNAPILLAI, M., AND MAILVAGANAM, A. W. *Phys. Rev.*, **70**, 94–5 (*July* 1 *and* 15, 1946).—The methods of Abstr. 2349 (1946) have been extended to calculate the lunar tidal influence on meson intensity. A maximum amplitude of semi-diurnal variation of $0{\cdot}012\%$ is obtained, which is to be compared to Duperier's experimental value of $0{\cdot}023$ [Abstr. 3172 (1946)].

537.591.5 3174

Cosmic radiation above 40 miles. GOLIAN, S. E., KRAUSE, E. H., AND PERLOW, G. J. *Phys. Rev.*, **70**, 223–4 (*Aug.* 1 *and* 15, 1946).—Data were transmitted by radio from counters contained in a German V2 rocket, and were received for 41 sec, from 200 000 to 350 000 ft. Total counts and various coincidences were recorded, and the results are given here. Total counts from unshielded counters increased to $20\times$ the sea level rate, and shielded counters $35\times$, owing to the absence of soft components. Analysis of the coincidence counts show that many-particle showers are produced at high altitudes in the structure adjacent to the counters.

537.591.8 3175

Meson production in copper. BASU, C. *Nature, Lond.*, **158**, 379–80 (*Sept.* 14, 1946).—A photograph is shown of a pair of tracks in a cloud chamber, diverging from a point in the magnetic field coils surrounding the chamber. Each has energy 500 eMV and neither produces electron cascades in a Pb absorber. The tracks are interpreted as those of a proton, and of a meson created by it.

538 3176

International Conference on Magnetism, Strasbourg, 21–24 May, 1939. BARNETT, S. J. *Science*, **104**, 70–3 (*July* 26, 1946).—A summary account is given of 18 reports submitted to the conference. The subjects covered include: magneto-optics, especially in relation to paramagnetism; theory of ferromagnetism; the gyromagnetic effect; cooling by adiabatic demagnetization; paramagnetic relaxation; theory of paramagnetism; magnetic anisotropy of crystals.

538.222 3177

Paramagnetic dispersion in vanadous ammonium sulphate. EISSES, J., GROENDIJK, H., AND GORTER, C. J. *Physica, 's Grav.*, **7**, 865–8 (*Nov.*, 1940).—In agreement with theoretical prediction, the dispersion measurements here reported show an analogy between V^{++} salts and Cr^{+++} salts, which are isoelectronic.

538.224 3178

Relation between the diamagnetic susceptibilities of ions in solution and in the crystalline state. LEE, F. H. *Science*, **104**, 191 (*Aug.* 23, 1946).—The relationship $(-X)_s = a_1\ (-X)_c - b$, has been found to hold (s, solution; c, crystalline) where $a_1 = 1{\cdot}09$, $b_1 = 1{\cdot}0$ for alkali and halide ions, and $a_1 = 1{\cdot}15$, $b_1 = 5{\cdot}8$ for alkaline earth ions (except Be). The susceptibilities are expressed in 10^6 c.g.s. units/gm ion.

538.242 3179

On the theory of the gyromagnetic effects. GORTER, C. J., AND KAHN, B. *Physica, 's Grav.*, **7**, 753–64 (*Oct.*, 1940).—A new general theory of the Einstein–de Haas effect for paramagnetic substances is given. It shows how the diagonal elements of the magnetic moment of paramagnetic atoms or ions contribute to the effect, whilst the non-diagonal elements only contribute provided the crystalline electric field has no cylindrical symmetry around the direction of the applied magnetic field. Applications of the theory are made to salts of the rare earths and elements of the Fe group, a table being given to show the agreement between calculated and experimental values of the gyromagnetic constant for ions of the Fe group. Applications to the ferromagnetic substances and to gases are also given. Finally, it is shown how this theory explains the equality of the gyromagnetic constants deduced from the Barnett and the Einstein–de Haas effects. G. F. H.

538.312 = 4 3180

On an interpretation of Maxwell's equations. BOUTHILLON, L. *C.R. Acad. Sci., Paris*, **222**, 871–3 (*April* 8, 1946) *In French.*—Let **E**, **H** denote the electric and magnetic field intensities, **D**, **B** the electric displacement and magnetic induction, **P** the electric polarization, **I** the magnetization, so that $\mathbf{D} = \mathbf{E} + 4\pi\mathbf{P}$, $\mathbf{B} = \mathbf{H} + 4\pi\mathbf{I}$. Let a_e and a_m be constants depending on the choice of units, ρ the space-charge density, **i** the density of the total electric current, **j** the total "magnetic current," defined as $\mathbf{j}_1 + \mathbf{j}_2$, where $4\pi\mathbf{j}_1 = a_e(\partial\mathbf{I}/\partial t)$, and $\mathbf{j}_2 = -a_e \operatorname{curl}\mathbf{P}$. Maxwell's equations may then be written:

$$-\operatorname{curl}\mathbf{D} = 4\pi\mathbf{j}/a_e + \partial\mathbf{H}/\partial t$$
$$\operatorname{curl}\mathbf{B} = 4\pi\mathbf{i}/a_m + \partial\mathbf{E}/\partial t$$
$$\operatorname{div}\mathbf{E} = 4\pi\rho/k,\ \operatorname{div}\mathbf{H} = 4\pi\sigma/\mu$$

where k and μ are the permittivity and permeability, and $\sigma(= -\mu \operatorname{div}\mathbf{I})$ is the density of magnetic poles. In this form, it is stated, the equations have the maximum symmetry. V. C. A. F.

538.56 : 535.12 = 4 *see Abstr.* 3105

538.569.4 : 539.13 : 535.343.4–14 *see Abstr.* 3124

538.652 3181

The effect of transverse magnetic field on the longitudinal Joule magnetostriction effect in nickel. SHARMA, O. P. *Indian J. Phys.*, **19**, 202–9 (*Oct.*, 1945).—The effect predicted by Williams [Abstr. 110 (1912)] has been observed for low values of longitudinal magnetic fields, using Williams' method of combining mechanical and optical magnifications [Abstr. 2623 (1927)]. Since the magnification of the present apparatus ($\sim 10^6$) is insufficient, no quantitative conclusions have been drawn. The effect has been explained on Becker's ideas, assuming that the effect of a transverse field is equivalent to that of tension.

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539.13 : 538.569.4 : 535.343.4–14 *see Abstr.* 3124

539.132 3182

A note concerning the Coriolis contribution to the energy of a symmetric polyatomic molecule. NIELSEN, H. H. *Phys. Rev.*, **70**, 184–6 (*Aug.* 1 *and* 15, 1946).—By a third-order perturbation calculation it is shown that the degenerate Coriolis interaction term in the vibration-rotation energy of a symmetric polyatomic molecule should be written $\mp 2\sum_t \zeta_t l_t K C_v$ rather than $\mp 2\sum_t \zeta_t l_t K C_e$, C_e being equal to $(h/8\pi^2 I_{zz}^{(e)}c)$ and $C_v = C_e - \sum_t (v_t + g_t/2)\Gamma_t$, Γ_t being a constant $\gamma_t + \sum_{t'\sigma'\sigma} \zeta_{t\sigma,\, t'\sigma'}{}^2 (3\omega_t + \omega_{t'})/(\omega_i{}^2 - \omega_{t'}{}^2)$ where γ_t is the usual correction term of the effective reciprocal of inertia.

539.132 3183

The vibrational levels of an anharmonic oscillator. TER HAAR, D. *Phys. Rev.*, **70**, 222–3 (*Aug.* 1 *and* 15, 1946).—An unnoticed approximation in Morse's calculations [Abstr. 63 (1930)] is pointed out, and the conditions for rigorous determination of the levels worked out.

539.133 3184

An electron diffraction investigation of dimethylketene dimer. LIPSCOMB, W. N., AND SCHOMAKER, V. *J. Chem. Phys.*, **14**, 475–9 (*Aug.*, 1946).—An electron diffraction investigation of dimethylketene dimer confirms the 2,2,4,4-tetramethylcyclobutadione-1,3 structure. The following parameters were determined for the symmetrical model: C – C (ring) = $1{\cdot}56 \pm 0{\cdot}05$ Å, C – $CH_3 = 1{\cdot}54 \pm 0{\cdot}05$ Å, C = O = $1{\cdot}22 \pm 0{\cdot}04$ Å, $\angle$ C – CO – C = $93° \pm 6°$, and $\angle$ CH_3 – C – $CH_3 = 111° \pm 6°$. The limits of error assigned to the angles apply only if simultaneous variation is excluded; otherwise much larger limits must be assigned. A notable feature of the structure is the large temperature factor which must be ascribed to the interatomic distances greater than 3 Å. The relation of this temperature factor to the unusually large atom polarization is discussed in terms of the probable amplitudes of the pertinent modes of vibration of the molecule.

539.153 3185

Wave function for the ground state of lithium. HUANG, K. *Phys. Rev.*, **70**, 197–202 (*Aug.* 1 *and* 15, 1946).—A variational calculation of the ground state $1s^2 2s^1 S$ of Li is carried out with a 3-electron wave function. The energy comes out to be $-14{\cdot}914$ Rh, compared with the value $-14{\cdot}838$ obtained by the best wave function not containing interaction terms and the spectroscopic value $-14{\cdot}956$.

539.154.2 = 4 3186

A new representation of the periodic table of the elements. TA, Y. *Ann. Phys., Paris*, **1**, 88–99 (*Jan.–Feb.*, 1946) *In French.*—Recently some spatial representations have been made of the Mendéleeff classification of the elements, and the present author submits a new viewpoint based on a plane representation by which a law of formation of the electronic shells for the elements has been deduced, viz. the

electrons are arranged in successive sub-groups about the atom nucleus in such a manner that the mixed quantum t may increase regularly. Since several sub-groups may have the same value for this number, the formation commences with the sub-group relating to the smallest value of n. When all the sub-groups of the same value t are formed according to the increasing values of n, the new electron is placed in the sub-group corresponding to the value of t increased by unity and to the smallest value of n; and so on. All the anomalies in the periodic table are resolved by this law of formation, which also accounts for chemical, optical and magnetic properties ($2n^2$ represents the maximum number of electrons which the electronic shell may contain).

H. H. HO.

539.155.2 : 541.133.1 *see Abstr.* 3218

539.16 = 3 3187

Uranium in rocks and deposits in the Erzgebirge cleavage. HOFFMANN, J. *S.B. Akad. Wiss. Wien.*, **148**, *IIa* (*Nos.* 3–4) 189–205 (1939) *In German.*

539.16.08 = 3 3188

Problems relating to methods for the determination of very small emanation and quantities of radium, and the radium content of limestone. KROPF, F. *S.B. Akad. Wiss. Wien.*, **148**, *IIa* (*Nos.* 3–4) 163–77 (1939) *In German.*

539.163 = 3 3189

Uranium and thorium determinations in limestones and dolomites and the question of radioactive equilibrium in these minerals. LAHNER, I. *S.B. Akad. Wiss. Wien.*, **148**, *IIa* (*Nos.* 3–4) 149–62 (1939) *In German.*

539.163.1 3190

Spontaneous emission of neutrons from uranium. SCHARFF-GOLDHABER, G., AND KLAIBER, G. S. *Phys. Rev.*, **70**, 229 (*Aug.* 1 *and* 15, 1946).—Spontaneous emission of neutrons from U was observed with a H-filled ionization chamber recording neutrons of energy >100 ekV. The partial decay constant for spontaneous fission for the "average" U atom $\simeq 7\times10^{-24}$ sec^{-1}.

539.163.1 3191

Mass assignment of 2·6 *h* Ni^{65}. SWARTOUT, J. A., BOYD, G. E., CAMERON, A. E., KEIM, C. P., AND LARSON, C. E. *Phys. Rev.*, **70**, 232 (*Aug.* 1 *and* 15, 1946).

539.163.2 3192

The positron-spectrum emitted by radiophosphorus $_{15}P^{32}$. BARENDREGT, F., GRIFFIOEN, J., AND SIZOO, G. J. *Physica, 's Grav.*, **7**, 860–4 (*Nov.*, 1940).—Cloud-chamber measurements were made of the intensity and energy-distribution of the positrons emitted by $_{15}P^{32}$. On the assumption that the positrons are due to the materialization of the kinetic energy of the fast β-particles, the coefficient of internal conversion for this process turns out to be 0·064.

539.163.2 3193

On the positive particles appearing near beta-ray emitters. SMITH, L., AND GROETZINGER, G. *Phys. Rev.*, **70**, 96–7 (*July* 1 *and* 15, 1946).—Cloud chamber observations were made in which the loss of momentum of the positive particles [see Abstr. 1363 (1944)] from P^{32} penetrating an Al foil across the chamber could be measured. These showed a behaviour similar to electrons, and were certainly not more penetrating. The momentum spectra was unlike the characteristic β-decay spectrum. The evidence suggested a mass > positron, which would account for the absence of annihilation radiation. The persistence of the appearance of the particles when the source is surrounded by absorber indicates that they are secondaries of a penetrating radiation, whose absorption rate > that for 0·5 eMV γ-rays, but the numbers produced greatly exceed the theoretical rate for pair-production. A few tracks could be definitely attributed to positive particles originating in the foil or chamber wall.

539.163.2 3194

Radioactivity of Be^{10}. MCMILLAN, E. M., AND RUBEN, S. *Phys. Rev.*, **70**, 123–6 (*Aug.* 1 *and* 15, 1946).—The formation of radioactive Be^{10} by the (d, p) reaction from Be has been observed. The assignment of the activity to Be is the result of very careful chemical separations. Be^{10} emits negative electrons with an upper limit of 560 ± 50 ekV (end point in Al = 180 ± 20 mg/cm²). The half-life is very long; data are given from which its value could be computed if the yield were known.

539.163.2 3195

The disintegration of Na^{24} and P^{32}. SIEGBAHN, K. *Phys. Rev.*, **70**, 127–32 (*Aug.* 1 *and* 15, 1946).—The disintegration of Na^{24} and P^{32} has been studied by means of a β-spectrometer of the lens type. The γ-radiation of Na^{24} consists of only two γ-lines in cascade, the energies of which have been determined as 1·380 and 2·758 eMV. $E\beta_{max}$ for Na^{24} is 1·390 eMV and for P^{32} 1·712 eMV. In order to obtain β-spectra without secondary electrons, exceedingly thin foils and very small quantities of active materials have been used. With these precautions it appears that the electron distributions follow the allowed form of β-spectra. However, Na^{24} and P^{32} are empirically forbidden spectra of the first and second order, respectively. According to the theory of forbidden spectra developed by Uhlenbeck and Konopinski [Abstr. 2303 (1941), 929 (1944)], the distribution for at least P^{32} would differ from the allowed one.

539.163.2 3196

The disintegration of I^{128}. SIEGBAHN, K., AND HOLE, N. *Phys. Rev.*, **70**, 133–5 (*Aug.* 1 *and* 15, 1946).—The β- and γ-radiations of the 25 min activity of I^{128} have been investigated by means of a β-spectrograph and a special technique for the γ-determination. The disintegration is shown to be complex. The main transition (93%) occurs to the ground level in X^{128} with the release of 2·02 eMV energy. A faint γ-ray of 0·428 eMV is found, corresponding to an excited level in X^{128}.

539.163.4 : 545.8 *see Abstr.* 3231, 3232, 3233, 3234

539.165.08 : 537.533.72 *see Abstr.* 3160

539.165.2 : 550.93 = 3 3197

The hypothesis of the variation in time of β-decay and the possibility of its experimental proof. HOUTERMANS, F. G., AND JORDAN, P. *Z. Naturforsch.*, **1**, 125–30 (*March*, 1946) *In German.*—In the first section the law for β-decay and K-electron capture is derived on the basis of the Dirac-Jordan cosmological theory.

The possibility of an experimental test of the time variation of β-decay is then discussed. The second section deals with the hypothesis of Weizsäcker that A^{40} present in the atmosphere is derived from K^{40} by *K*-capture. The half-value time of this process is estimated on the assumption that the quantity of K^{40} n the earth's crust is responsible for the supply of A^{40}. As a result, with the value of the half-life of K^{40} of $1{\cdot}42\times10^{9}$ years, the ratio k of *K*-capture to total decay of K^{40} is obtained as a function of the age of the atmosphere. The third section discusses the consequences of the decay law in respect of age determinations by the Rb–Sr method. Finally, the constancy of β-decay is discussed using the end-point of the Th series in specimens of different geological ages. G. O. B.

539.166 3198

Gamma-ray anomaly following the atomic bomb te.t of July 1, 1946. HERZOG, G. *Phys. Rev.*, **70**, 227–8 (*Aug.* 1 *and* 15, 1946).—A γ-ray recorder at Houston, Texas, showed a gradual increase of counting rate up to 177% of normal, beginning on July 4th and reaching peak about 7 hrs later. The rate then declined to normal in about 16 hrs. The peak was 108 hrs after the explosion, which would correspond to a travelling speed of radioactive material >60 m.p.h.

539.166.92 : 537.568 *see Abstr.* 3166

539.167.3 3199

Measurements on the period of radioactive phosphorus. MULDER, D., HOEKSEMA, G. W., AND SIZOO, G. J. *Physica*, *'s Grav.*, **7**, 849–59 (*Nov.*, 1940).

539.167.3 3200

Availability of radioactive isotopes. *Science*, **104**, 697–705 (*June* 14, 1946).

539.167.3 3201

Short-lived radioactivity from lithium bombarded with neutrons. POOLE, M. J., AND PAUL, E. B. *Nature*, *Lond.*, **158**, 482 (*Oct.* 5, 1946).—Of the two proposed reactions with slow neutrons, $Li^7(n,\gamma)Li^8$ [Abstr. 1399 (1936), 969 (1937)] or $Li^7(n,p)He^6$ [Abstr. 4889 (1938)], the former has been confirmed, by observation of the β-ray spectrum of the resultant nucleus. The cross-section $\sim10^{-27}$ cm^2. Alpha-particles due to the delayed break-up of the Be^8 formed from the β-decay of the Li^8 were detected in small numbers. A weak activity corresponding to He^6 β-decay was observed with fast neutron (4–13 eMV) irradiation of Li^7.

539.17 3202

Some nuclear disintegrations. SOONAWALA, M. F. *Indian J. Phys.*, **19**, 185–9 (*Oct.*, 1945).—Endothermy and exothermy of several nuclear disintegrations have been studied. The radioactive nuclei show pronounced exothermy with a release of energy per disintegration ranging from 165 eMV to 236 eMV according to the structure assigned to the nucleus. The potential depth within the nucleus varies from about 4×10^{-18} for the stable nuclei to 10^{-20} for the unstable radioactive nuclei.

539.185 = 3 3203

On the derivation of the Breit–Wigner formula. FLÜGGE, S. *Z. Naturforsch.*, **1**, 121–4 (*March*, 1946) *In German.*—A direct derivation of the formula for the scattering of neutrons by nuclei by the original method of Breit and Wigner, assuming one intermediate state. Its purpose is to emphasize the relation between this formula and other similar resonance formulae in radiation theory. G. J. K.

539.185 3204

Neutron beam spectrometer studies of boron, cadmium, and the energy distribution from paraffin. RAINWATER, J., AND HAVENS, W. W., JR. *Phys. Rev.*, **70**, 136–53 (*Aug.* 1 *and* 15, 1946).—A slow neutron velocity selector has been developed for use with the cyclotron. By the method of arc modulation, neutron production can be usually confined to intervals of 10–200 μsec out of a 1 000–10 000 μsec cycle. Neutrons slowed down in paraffin are detected by BF_3 proportional counters. Excellent collimation is obtained by using an extensive B_4C and Cd collimating system. Experiments were conducted principally at 5·4 m source-detector distance. A special selector system counts all the neutrons detected and also selectively counts those detected in an adjustable timed interval after the cyclotron burst. The slow neutron energy distributions from paraffin "source" slabs were shown to be of a modified Maxwellian form with an asymmetrical high energy "tail." Data for the resonance absorption by Cd were well matched by a one-level Breit–Wigner formula having $E_0=(0{\cdot}180\pm0{\cdot}008)$ eV, $\Gamma=(0{\cdot}112\pm0{\cdot}006)$ eV, $\sigma_0=(7\,800\pm800)\times10^{-24}$ cm^2/atom. The results of measurements with several B filters over the range of 0·01 eV to over 100 eV were well matched by the $1/v$ relation,

$$\sigma_B=(118\pm4)E^{-\frac{1}{2}}\times10^{-24}\ \text{cm}^2/\text{atom}.$$

539.185.7 3205

The slow neutron cross sections of indium, gold, silver, antimony, lithium, and mercury as measured with a neutron beam spectrometer. HAVENS, W. W., JR., AND RAINWATER, J. *Phys. Rev.*, **70**, 154–73 (*Aug.* 1 *and* 15, 1946).—The variations of the slow neutron transmissions of In, Au, Ag, Sb, Li and Hg have been investigated as a function of the time-of-flight of the incident neutrons for a 5·4 m path by use of a neutron beam spectrometer. A method of analysis is developed for determining E_0 and $\sigma_0\Gamma^2$ for resonances above 1 eV based on the experimental transmission curves and the Breit–Wigner theory. The positions of the levels located, listed in order of importance for each element, are: In, $(1{\cdot}44\pm0{\cdot}04)$ eV; Au, $(4{\cdot}8\pm0{\cdot}2)$ eV; Ag, $(5{\cdot}11\pm0{\cdot}2)$ eV, $(13{\cdot}7\pm1)$ eV, and (43 ± 5) eV; Sb, $(6{\cdot}3\pm0{\cdot}5)$ eV, $(19{\cdot}2\pm1{\cdot}0)$ eV, and indications of other unresolved levels in the region of 50 to 500 eV; Li, only a $1/v$ cross section; Hg, a negative level at $(-2{\cdot}0\pm0{\cdot}2$ eV) and indications of unresolved positive levels above 25 eV. In the thermal region, the Ag, Sb and Li cross-section curves can be resolved into the sum of a constant term and a $1/v$ term. If E is the neutron energy in eV, these are: Ag, $[(9{\cdot}05\pm0{\cdot}10)E^{-\frac{1}{2}}+(6{\cdot}6\pm0{\cdot}5)]\times10^{-24}$ cm^2/atom; Sb, $[(0{\cdot}64\pm0{\cdot}02)E^{-\frac{1}{2}}+(4{\cdot}2\pm0{\cdot}3)]\times10^{-24}$ cm^2/atom; Li, $[(11{\cdot}5\pm0{\cdot}2)E^{-\frac{1}{2}}+(1{\cdot}7\pm0{\cdot}2)]\times10^{-24}$ cm^2/atom; LiF was used in the Li measurements and a value $2{\cdot}5\times10^{-24}$ cm^2/atom has been deducted for the F. The Hg cross section below 5 eV was well matched by the relation $(64\pm3)E^{-\frac{1}{2}}(1+E/2{\cdot}0)^{-2}\times10^{-24}$ cm^2/atom.

STRUCTURE OF SOLIDS 539.2

539.217.3 = 4 3206

Penetration of water into activated carbon. COURTY, C. *C.R. Acad. Sci., Paris,* **222,** 880–2 (*April* 8, 1946) *In French.*—The mechanism of the penetration of water into dry or moist activated C, and its dependence on previously adsorbed air or oxygen, are discussed. Experimental data are given for the variation in the weights of samples of dry C and humidified C at intervals over a period of 2 years. N. M. B.

539.234 : 541.128 3207

Structure of catalytic metal films. ELEY, D. D. *Nature, Lond.*, **158,** 449 (*Sept.* 28, 1946).

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.312 : 531.258 *see Abstr.* 3071

539.374 : 539.89 3208

The tensile properties of several special steels and certain other materials under pressure. BRIDGMAN, P. W. *J. Appl. Phys.*, **17,** 201–12 (*March,* 1946).—In continuation of previous work [Abstr. 568 (1946)] 4 stainless steels and 5 carbon steels were investigated under pressures up to 30 000 kg/cm², also single crystals of Sb, Te and Bi, borax glass, hard rubber and limestone, and Al, Cu, As, bronze, brass, cast iron and carboloy. J. S. G. T.

539.374 = 393 3209

Contribution to plasticity theory. VAN ITERSON, F. K. T. *Versl. Ned. Akad. Wet. Afd. Natuurk.*, **52** (*No.* 1) 5–11 (1943) *In Dutch.*—Plastic flow occurs in consequence of 3-dimensional stress, and in 2-dimensional plasticity problems, the principal stress normal to the section under consideration must be taken into account. Expressions are derived for the shearing and normal stresses on the 8 faces of an elemental octahedron, with its axes in the principal directions. Plastic flow commences as soon as the shearing stress (which is a function of the principal stress differences only) attains a value $\tau = \sqrt{2}\sigma_v/3$, or the elongation caused by the shearing stresses attains a value $\varepsilon = \sigma_v/G$, or the distortion energy $A'' = \sigma_v^2/6G$ (σ_v is the elastic or flow limit). An equation is often required in plane or rotatory problems to determine the principal stress normal to the section under consideration. It is proved that in this case the stress adjusts itself to one of the two other principal stresses, so that two of the three are equal.

539.374 = 4 3210

Plastic deformations near notches. VAN ITERSON, F. K. T. *Proc. Ned. Akad. Wet.*, **45** (*No.* 2) 112–19 (1942) *In French.*—The lines of plastic glide in the neighbourhood of holes and notches of various shapes are sketched. The treatment is mainly qualitative, but expressions for the maximum stress are given in some cases. A. J. C. W.

539.384 : 621.824 = 3 3211

Analytical method for determining the elastic line of shafts supported on two or three bearings. MEYER-HALLER, E. *Schweiz. Arch. angew. Wiss. Tech.*, **11,** 295–305 (*Oct.*, 1945) *In German.*—[Abstr. 2954 B (1946)].

539.4.01 3212

Influence of strain rate and temperature on the mechanical properties of monel metal and copper. MCADAM, D. J., JR., GEIL, G. W., AND WOODARD, D. H. *Proc. Amer. Soc. Test. Mater.*, **46,** 49 *pp.* (1946).—The third stage of creep may be initiated by the formation of microscopic cracks, predominantly intercrystalline. Cracking occurs when the rising true stress reaches a technical cohesion limit determined by the temperature, strain rate, and amount of plastic deformation. Progressive disintegration thus begins and continues to complete fracture. Both the second-stage flow stress and the cohesion limit increase with decrease in temperature and with increase in the strain rate. Decrease in temperature or increase in strain rate increases the cohesion limit to a greater extent than the flow stress; the ductility thus increases. A study is made of the influence of temperature and the strain rate on the second-stage flow stress, ultimate stress, technical cohesive strength and ductility. By combining these results with previously published data, the view is broadened to include a temperature range from −188°C to the melting point for monel metal and copper.

539.4.011.25 3213

A thermodynamic criterion for the fracture of metals—a criticism. ZENER, C. *Phys. Rev.*, **70,** 225–6 (*Aug.* 1 *and* 15, 1946).—It is pointed out that in Saibel's criterion [Abstr. 2680 (1946)] one quantity (the "strain energy" at fracture) is usually dependent on the conditions of test, whereas the others are invariable thermodynamic factors. Furthermore, the "strain energy" is very structure-sensitive, which the other factors are not.

539.431 3214

Inert atmospheres as fatigue environments. GOUGH, H. J., AND SOPWITH, D. G. *J. Inst. Met.*, **72,** 415–21 (*June,* 1946).—To complete earlier experiments [Abstr. 750 B (1935), 396 B (1933)] indicating O_2 catalysed by H_2O vapour as the cause of decreased fatigue resistance, investigations were made on annealed Cu and brass in an atmosphere of N_2, with and without H_2O vapour. The conclusion is reached that neither O_2 nor H_2O alone have any effect on Cu; for brass, the decrease is probably due, in about equal proportions, to N_2, O_2 and H_2O, each acting independently.

539.434 3215

Mechanism of creep in metals. WOOD, W. A., AND TAPSELL, H. J. *Nature, Lond.*, **158,** 415–16 (*Sept.* 21, 1946).—Under normal static loading of a polycrystalline metal specimen, the grains break down into randomly orientated crystallites; with a single crystal specimen, however, the crystallites are approximately parallel [Abstr. 619 (1940), 3500 (1939)]. It has been found that a polycrystalline specimen, subjected to the slow continuous deformation known as "creep," shows parallel orientation of the crystallites, i.e. it deformed as though it were a single crystal.

539.89 : 539.374 *see Abstr.* 3208

PHYSICAL CHEMISTRY 541

REACTION KINETICS 541.121/.128

541.126 3216

Chain-initiating process in the reaction between hydrogen and oxygen between the second and third explosion limits. ASHMORE, P. G., AND DAINTON, F. S. *Nature, Lond.*, **158**, 416 (*Sept.* 21, 1946).

541.127 : 534.321.9 3217

The velocity of tarnishing on metals as influenced by supersonic waves. HEDVALL, J. A., AND EKWALL, G. *Ark. Kemi. Min. Geol.*, **18 A** (*No.* 2) *Paper* 11, 25 *pp.* (1944).—The rates of tarnishing of a polished Cu rod by I_2 vapour and of an Fe rod by O_2 were followed by observing the interference colours produced by the film of reaction product. The rods could be set in longitudinal supersonic vibration with nodes at the ends. With Cu the observations could be continued up to the seventh order of interference, but with Fe up to the first order only. The increase with time t of the thickness of the tarnish layer on Cu obeyed the law $x^2 = ct$ (c = constant), showing that the rate of reaction is controlled by diffusion through the film of product; $c = 0{\cdot}63$ with, and $c = 0{\cdot}29$ without, the supersonic waves. The oxidation of Fe followed the equation $t = 0{\cdot}004\,(e^{bx} - 1)$, and the constant b was slightly higher with supersonic waves than without; diffusion is again the controlling factor, but the oxide layer is now unstable and ages to a more stable form during the experiment. The accelerating effect of the supersonic vibrations is too large to be accounted for by the rise in temperature they produce, and is probably due to disturbance of the reaction layer, which results in faster diffusion. S. J. G.

541.127.2 : 541.18 : 532.74 *see Abstr.* 3083

541.127.2 : 542.958.1 *see Abstr.* 3227

541.128 : 539.234 *see Abstr.* 3207

ELECTROCHEMISTRY 541.13

541.133.1 : 539.155.2 3218

The concentration of ^{39}K and ^{41}K by balanced ion migration in a counterflowing electrolyte. BREWER, A. K., MADORSKY, S. L., AND WESTHAVER, J. W. *Science*, **104**, 156–60 (*Aug.* 16, 1946).—Changes of >50% in the relative concentration of K^{39} or K^{41} were obtained with a cell with electrolyte flow adjusted to be equal and opposite to the transport rate of K^+ ions; the faster moving K^{39} ions move against the stream towards the cathode compartment. To reduce the rate of remixing and to give the effect of a multiple stage fractionation process the electrolysis is performed in a fine grained packing of uniform porosity (sand, glass, wool, etc.). The separation coefficient had a maximum value of 1·0039. The theory is briefly outlined.

541.133.1 = 4 3219

Mobility and diffusion of ions. MONTEL, É. *C.R. Acad. Sci., Paris*, **222**, 873–5 (*April* 8, 1946) *In French.*

541.135.85 : 537.312.5 3220

Electron emission and the photovoltaic effect. FERGUSON, A. L., AND KISSIN, G. H. *Trans. Electrochem. Soc.*, **89** (*Prepr. No.* 21) 17 *pp.* (1946).—The role of electron emission in modern theories of cation deposition and electrode potential phenomena is discussed, and the possible relationship between photopotentials and the energy of electron emission from electrodes immersed in electrolytic solution is defined. An electrode system, comprising a metallic solution of Na in liquid NH_3, was established, by means of which the validity of the electron emission or photoelectric theory of the photovoltaic effect for metallic electrodes could be experimentally tested. No observable photovoltaic effect was obtained for the Na in liquid NH_3 electrode, a system which is known to emit electrons when illuminated, and it is therefore concluded that photoelectric emission alone is not a sufficient condition for the generation of photovoltaic effects for metals in contact with solutions of their ions.

PHOTOCHEMISTRY 541.14

541.144 3221

Free radical determination in biacetyl photolysis. ASCAH, R. G., BURTON, M., RICCI, J. E., AND DAVIS, T. W. *J. Chem. Phys.*, **14**, 487–94 (*Aug.*, 1946).

541.145 : 542.952.6 *see Abstr.* 3226

COLLOIDS . ADSORPTION 541.18

541.18 : 535.343.32 : 532.74 *see Abstr.* 3084

541.18 : 541.127.2 : 532.74 *see Abstr.* 3083

541.183 : 532.74 *see Abstr.* 3085, 3086

541.183.1 : 536.75 3222

Standard entropy of adsorption. WARD, A. F. H., AND TORDAI, L. *Nature, Lond.*, **158**, 416 (*Sept.* 21, 1946).—A formula is given by which the entropy of adsorption of a solute on to a solution/air interface can be determined from the limiting slope of the surface tension/concentration curve [see Abstr. 2974 (1946)]. Values calculated in this way for some fatty acids are presented in a table.

CHEMICAL STRUCTURE 541.2/.6

541.64 : 532.72 *see Abstr.* 3082

541.651 : 535.343 *see Abstr.* 3120

541.651–31 : 535.343 *see Abstr.* 3121

CHEMICAL PROCESSES . APPARATUS 542

542.231.7 3223

Modified gate valve for control of water flow. ROBERTSON, G. R. *Industr. Engng Chem.* (*Analyt. Edit.*) **18**, 459 (*July*, 1946).

542.45 3224

Constant-level feeder for thermostatic baths and continuous evaporators. TELANG, M. S. *Industr. Engng Chem.* (*Analyt. Edit.*) **18**, 453–4 (*July*, 1946).—A new and simple arrangement is described. A list of 27 references is appended.

542.69 3225

Mercury cleaning apparatus for continuous operation. HOLMES, F. E. *Industr. Engng Chem.* (*Analyt. Edit.*) **18**, 451–2 (*July*, 1946).

542.952.6 : 541.145 3226

The photochemical polymerization of butadiene. VOLMAN, D. H. *J. Chem. Phys.*, **14**, 467–74 (*Aug.*, 1946).

542.958.1 : 541.127.2 3227

Kinetics of aromatic nitration: the nitronium ion. HUGHES, E. D., INGOLD, C. K., AND REED, R. I. *Nature, Lond.*, **158**, 448–9 (*Sept.* 28, 1946).

542.958.1 3228

Cryoscopic proof of the formation of nitronium ion. GILLESPIE, R. J., GRAHAM, J., HUGHES, E. D., INGOLD, C. K., AND PEELING, E. R. A. *Nature, Lond.*, **158**, 480 (*Oct.* 5, 1946).

542.958.1 3229

Isolation of salts of the nitronium ion. GODDARD, D. R., HUGHES, E. D., AND INGOLD, C. K. *Nature, Lond.*, **158**, 480 (*Oct.* 5, 1946).

542.958.1 : 535.375.5 *see Abstr.* 3131

CHEMICAL ANALYSIS 543/545

545.37 3230

Influence of the nature and concentration of supporting electrolyte on polarographic diffusion of current. COLLENBERG, O., AND SCHOLANDER, A. *Nature, Lond.*, **158**, 449–50 (*Sept.* 28, 1946).

545.8 : 539.163.4 3231

Analytical procedure for measurement of long-lived radioactive sulphur, S^{35}, with Lauritzen electroscope, and comparison of electroscope with special Geiger counter. HENRIQUES, F. C., JR., KISTIAKOWSKY, G. B., MARGNETTI, C., AND SCHNEIDER, W. G. *Industr. Engng Chem.* (*Analyt. Edit.*) **18**, 349–53 (*June*, 1946).—S^{35} used in tracer investigations can be estimated to about 2% accuracy by oxidizing S-containing samples to sulphate by the Carius method followed by precipitation as benzidine sulphate under specified conditions. The soft β-ray activity of the precipitate is determined with either a modified Lauritzen electroscope or a specially modified Geiger counter, the former being considered preferable in routine work. Correction is made for self-absorption of β-particles in the benzidine sulphate, a general equation and a table of correction factors being given. C. B. A.

545.8 : 539.163.4 3232

Analytical procedure for measurement of radioactive arsenic of 90-day half-life. HENRIQUES, F. C., JR., AND MARGNETTI, C. *Industr. Engng Chem.* (*Analyt. Edit.*) **18**, 415–17 (*July*, 1946).—The procedure depends upon the isolation of As metal by reduction with hypophosphite, collection on a Selas filter plate, and measurement of the activity inside the chamber of a Lauritzen electroscope. The utilization of 90-day As rather than the 16-day isotope extends considerably the duration of experimentation following cyclotron bombardment.

545.8 : 539.163.4 3233

Analytical method for determination of long-life carbon C^{14}. HENRIQUES, F. C., JR., AND MARGNETTI, C. *Industr. Engng Chem.* (*Analyt. Edit.*) **18**, 417–19 (*July*, 1946).—A detailed quantitative procedure for the measurement of radio-activity due to long-life C^{14} incorporated into organic compounds is described and evaluated. The method is based on the insertion of CO_2 gas into a quartz ionization chamber attached to a Lauritzen electroscope. The assemblage of this detection apparatus is described in detail. The method is especially suitable to biological work, since it will measure 3×10^{-5} microcurie of C^{14} diluted with as much as 20 millimoles of ordinary C.

545.8 : 539.163.4 3234

Analytical procedure for measurement of radioactive hydrogen (tritium). HENRIQUES, F. C., JR., AND MARGNETTI, C. *Industr. Engng Chem.* (*Analyt. Edit.*) **18**, 420–2 (*July*, 1946).—Radioactive analysis of organic compounds containing H^3 is based on combustion to water and the quantitative conversion of this water to hydrogen for insertion in a quartz ionization chamber attached to a Lauritzen electroscope. A procedure for obtaining tritium water samples of high specific activity is described.

CRYSTALLOGRAPHY 548

548.0 : 535.375.5 *see Abstr.* 3132, 3133

548.0 : 535.525 = 5 3235

New method for the determination of the angle of the optic axes of minerals. RITTMANN, A. *Ric. Sci. Ricostruz.*, **16**, 307–8 (*March–April*, 1946) *In Italian.*

548.0 : 537.228.1 *see Abstr.* 3152

548.53 : 553.621 3236

Note on the thickness of quartz wafers for observed surface phenomena. D'EUSTACHIO, D. *Phys. Rev.*, **70**, 229 (*Aug.* 1 *and* 15, 1946).—Quartz wafers used in previously described work [Abstr. 2401 (1946)] were found to be thinner than reported, owing to the presence of etch pits. The thickness was ~10 microns.

548.574 3237

Thermal etching of silver. SHUTTLEWORTH, R., KING, R., AND CHALMERS, B. *Nature, Lond.*, **158**, 482–3 (*Oct.* 5, 1946).—The production of grooves and striations on the polished surfaces of metal specimens on heating is described. The development of these markings at the elevated temperature was followed by a special technique. A tentative explanation is advanced.

548.73 3238

The crystal structure of synthetic boehmite. REICHERTZ, P. P., AND YOST, W. J. *J. Chem. Phys.*, **14**, 495–501 (*Aug.*, 1946).—Crystal structure computations have been made for synthetic boehmite, the α-modification of aluminium oxide monohydrate, using the powder method. The experimental data were found to fit an orthorhombic lattice with constants $a_0 = 2{\cdot}85_9$ Å, $b_0 = 12{\cdot}2_4$ Å, and $c_0 = 3{\cdot}69_1$ Å. The assignment of four AlO(OH) groups to this unit cell gives a calculated density of $3{\cdot}06_2$ g/cm³. The observed density is $2{\cdot}97_7$ g/cm³. The general space group extinctions were found to agree with those of D_{2h}^{17}. Generalized atomic co-ordinates

were roughly determined by application of Pauling's co-ordination theory for ionic crystals and the determinations refined by the usual intensity computations. The parameter values selected were $u_{Al} = -0{\cdot}334$, $u_{O_I} = 0{\cdot}287$, $u_{O_{II}} = 0{\cdot}067$. It is suggested that the inconsistencies which exist between the experimental and computed intensity data may be explained by the occurrence of a small quantity of γ–Al_2O_3 in the synthetic samples used. The value of $2{\cdot}47 \pm 0{\cdot}07$ Å obtained for the hydrogen bridge distance is discussed. This value is less than that observed for any previously determined structure.

548.73 : 537.583 : 621.385.13.032.216 3239

Studies of the interface of oxide coated cathodes. FINEMAN, A., AND EISENSTEIN, A. *J. Appl. Phys.*, **17**, 663–8 (*Aug.*, 1946).—[Abstr. 2884 B (1946)].

548.73 = 4 3240

Spectra from strictly monochromatic X-rays. ROSE, A.-J. *C.R. Acad. Sci., Paris*, **222**, 805–6 (*April* 1, 1946) *In French.*—The X-rays are brought to a focus at the entrance to the camera by means of a bent quartz crystal, and a slit arranged so that only the $K\alpha_1$ component enters. Debye–Scherrer photographs show very fine lines, with no trace of a continuous background. The corrections for eccentricity, beam divergence, length and diameter of the specimen, and refraction are considered, and the lattice parameter of Cu at 21°c is found to be $3{\cdot}6073 \pm 3$ kX.

A. J. C. W.

548.73 = 4 3241

X-ray study of certain chloro-esters of fatty acids. TRILLAT, J. J., AND BRENET, J. *C.R. Acad. Sci., Paris*, **222**, 878–80 (*April* 8, 1946) *In French.*

548.734.4 : 669.35.725 3242

Oscillating crystal X-ray method applied to orientation relationships. GUY, A. G. *Gen. Elect. Rev.*, **49**, 28–32 (*Aug.*, 1946).—The orientation of a precipitate relative to the matrix can be obtained from 5°-oscillation photographs of what was originally a single crystal. Reflections corresponding to the {100} planes of the precipitate are plotted in stereographic projection, the necessary angles being read from a Bernal chart. The orientation is thus determined within 2·5°, and stationary-crystal photographs can then be used to obtain greater accuracy if necessary. Results are given for CuBe precipitating from Cu containing 1·8% Be. A. J. C. W.

548.734.842.4 3243

Phase angle determination in X-ray crystallography. BOOTH, A. D. *Nature, Lond.*, **158**, 380 (*Sept.* 14, 1946).—The question is considered whether a more detailed study of the diffuse reflections caused by thermal motion of the crystal lattice would give information on the phase angles of the parent Bragg lattice. For a centro-symmetric group, phase angle determination degenerates into the determination of the sign of the structure factor, which is not possible if Bragg reflections alone are used since observations can only be made at discrete angles. Using the diffuse reflections, however, a *change* of sign between Bragg reflections would be indicated by zero reflection at some intermediate angle. Such zero reflection is not usually experimentally observable, owing to other background radiation, but it is possible in many cases to determine that there is *no* zero between Bragg reflections. The method has been applied to photographs of oxalic acid dihydrate.

GEOPHYSICS 55

550.341 : 534.24/.25 *see Abstr.* 3092

550.361 3244

Cooling of the earth. SLICHTER, L. B. *Bull. Geol. Soc. Amer.*, **52**, 561–600 (1941).—Observational data concerning the heat loss and heat generation in the earth are reviewed, and the possible importance of the transport of heat by thermal convection is indicated. The cooling of a rigid radioactive earth which solidified from the interior towards the surface with rapid transport of heat by convection is studied. The thermal problem is simplified by reducing it to an equivalent one for a non-radioactive earth. Steady-state and transient temperature distributions are computed for a number of different assumptions concerning the radioactivity and conductivity as functions of depth. At depths shallower than about 200 kilometers, thermal equilibrium between heat generation and losses by conduction appears to have been established, but below this depth the generation of heat is not necessarily reflected in the surface heat-flux. In analogy with the irreversible behaviour of lava flows in which the temperature of remelt much exceeds the original temperature of solidification, it is assumed that remelting by entrapped radioactive heat might require a temperature increase of a few hundred degrees or more. Under this hypothesis appreciable amounts of the radioactive elements could exist at depth without influencing thermal observations at the surface.

550.371 = 5 3245

Diurnal variation of the terrestrial electric field in Palermo. MEDI, E. *Ric. Sci. Ricostruz.*, **16**, 81–4 (*Jan.–Feb.*, 1946) *In Italian.*

550.384.3 3246

Induction effects in terrestrial magnetism. II. The secular variation. ELSASSER, W. M. *Phys. Rev.*, **70**, 202–12 (*Aug.* 1 *and* 15, 1946).—A brief survey of some of the observed features of the secular variation is first given. It is pointed out that not only the phases but also the magnitudes of the harmonic components, including the main dipole, are subject to large changes at the present time. There follows a brief study of the skin effect, which indicates that the observed variations of the dipole terms originate in a layer adjacent to the core's boundary several hundred km deep; those of the higher terms originate in a layer no more than 200 km deep. Next, the "coupling matrix" introduced in I [Abstr. 930 (1942)] is evaluated in form of a table of all matrix elements that contain vectors of dipole and quadrupole type but no higher harmonics. It is shown that a zonal fluid motion produces rotation of the tesseral magnetic dipole terms and also oscillatory changes in amplitude of these terms. There is one and only one type of matrix

element that represents an interaction of the main magnetic dipole with itself; the corresponding fluid motion is a meridional flow of quadrupole symmetry. With this term amplification or de-amplification occurs, depending on the sign of the velocity. The theory can thus account for all the observed components of the secular variation.

550.93 : 539.165.2 = 3 *see Abstr.* 3197

551.46.018.9 : 621.317.757 3247

A frequency analyzer used in the study of ocean waves. BARBER, N. F., URSELL, F., DARBYSHIRE, J., AND TUCKER, M. J. *Nature, Lond.*, **158**, 329–32 (*Sept.* 7, 1946).—[Abstr. 2855 B (1946)].

METEOROLOGY 551.5

551.501.6 3248

The tropogram, a new aerological diagram. AMBLE, O. *Arch. Math. Naturv. B*, **44** (*No.* 2) 24 *pp.* (1940).—The advantages and disadvantages of Stuve's diagram, the emagram, tephigram (Shaw) and aerogram (Refsdal) for use in finding pressures at levels of constant geopotential, and the geopotential of characteristic phenomena are discussed. A new form has been produced which is claimed to utilize space more effectively, show more clearly the vertical variation of temperature and humidity and permit more rapid determination of geopotential and energy. Corresponding curves for an aerological ascent are drawn on a tephigram, an aerogram, and a tropogram and it is said that the last named produces a higher degree of accuracy in calculating the amounts of energy released. R. S. R.

551.508.11 : 621.396.91 3249

Radio sonde transmitters. *CIOS Rep.*, XXVIII—20 (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 5 *pp.* (1946).—[Abstr. 2727 B (1946)].

551.508.99 3250

An improved ceiling-light clinometer. IVES, R. L. *Bull. Amer. Met. Soc.*, **26**, 288–91 (*Sept.*, 1945).—The instrument consists of a spirit-level type clinometer combined with a suitable illuminating system and battery. The instrument was found on test to be a big improvement on the standard pendulum type. An accuracy of 30′ of arc is claimed for the elevation. R. S. R.

551.510.535 : 621.396.11 : 621.396.96 3251

Extra-tropospheric influences on ultra-short-wave radar operation. APPLETON, E. V. *J. Instn Elect. Engrs, Pt IIIA*, **93** (*No.* 1) 110–13 (1946).—[Abstr. 2939 B (1946)].

551.515.21 3252

On the theory of cyclones. BJERKNES, J., AND HOLMBOE, J. *J. Met.*, **1**, 1–22 (*Sept.*, 1944).—The "tendency equation" is used to analyse the pressure changes produced in wave-shaped westerly flow. With sufficiently strong westerlies, horizontal divergence and convergence occur in such distribution as to cause eastward displacement of troughs and crests. When the westerlies drop below a "critical speed" the distribution of divergence and convergence is reversed. In the normal case of supercritical speed and increasing west wind with height, incipient waves will develop thermal asymmetry and will intensify. The same kind of irreversible growth of incipient waves would occur in easterlies which increase with height. Therefore the temperate westerlies in all seasons, and the subtropical easterlies in summer and autumn, are regions of dynamic instability, where, respectively, the extratropical and the tropical cyclones are generated. The tendency equation applied to closed circulations shows such distribution of pressure rise and fall as to make the patterns drift westwards unless they are strongly eccentric. The main reason for the usual eastward drift of closed isobar patterns in the temperate latitudes lies, however, in the fact that the superimposed wave pattern in the upper layers produces overcompensating accumulation of air where the low levels show depletion, and depletion of air where the low levels show accumulation. The behaviour of the composite low- and high-level depression is discussed from this viewpoint. R. S. R.

551.521.2 : 551.575 *see Abstr.* 3256

551.521.63 = 3 3253

Intensity of ultra-violet solar radiation in Finland. LUNELUND, H. *Comment. Phys. Math., Helsingf.*, **12** (*No.* 13) 21 *pp.* (1944) *In German.*—Tables are given of the intensities as measured over the years 1928–1931 in Southern Finland. Measurements were made with both a Cd and a K photo-cell. The agreement with the measurements made in other places in Finland is good. L. S. G.

551.543 = 4 3254

A general relation between the total and the local variations of pressure. BJÖRKDAL, E. *Met. Ann.*, **1** (*No.* 14) 377–84 (1943) *In French.*—A mathematical paper leading to a formula for the total variation of pressure in terms of the local variation for a column of air which is being deformed in the vertical as well as in the horizontal direction. The flow of heat into the column is also allowed for. G. C. McV.

551.553.11 3255

Tropical land and sea breezes (with special reference to the East Indies). KIMBLE G. H. T., AND OTHERS. *Bull. Amer. Met. Soc.*, **27**, 99–113 (*March*, 1946).—A detailed examination of land and sea breezes at Batavia has been used to form a general statement for the tropics. From considerations of all factors it is concluded that the sea breeze is strongest and steadiest in direction in the dry season, in regions with light annual rainfall or a very well-marked dry season, along hilly coasts preferably not forest-clad and with a prevailing onshore wind. Details of the speed, depth and extension inland are given. The land breeze is less predictable, is lighter than the sea breeze, and does not extend so far over the sea. R. S. R.

551.575 : 551.521.2 3256

On radiation cooling of a layer of fog. WEXLER, R. *Bull. Amer. Met. Soc.*, **26**, 217–19 (*June*, 1945).—To explain the lapse rate changes within a fog during radiative conditions at night, the theory of temperature changes in a fog whose upper portion remained at a fixed level were analysed. The cooling with time of the top surface of the fog is given by $T_1 - T_2 = 2Et/(a + b\sqrt{t})$ where E is the effective nocturnal radiation. Curves are plotted connecting cooling and time for different values of the eddy diffusivity. The equation is compared with that derived by Brunt and checked against results obtained by Heywood at Leafield. R. S. R.

551.576.11 3257

Relative humidity gradient and the form of cloud bases. DEPPERMAN, C. E. *Bull. Amer. Met. Soc.*, **26**, 267–70 (*Sept.*, 1945).—The Robitsch adiabatic diagram is used to determine the form of the cloud base with different variations of specific and relative humidity with height. It is shown that (*a*) for all temperature gradients the condition for flat cloud bases at a definite level of pressure is a certain definite relative humidity gradient with respect to pressure; (*b*) if the relative humidity is less (more) steep than the critical one for flat cloud bases there will be a tendency for cloud bases curved convex (concave) downward. R. S. R.

551.594 : 621.396.91 : 621.396.11 3258

Elements of radio meteorology: how weather and climate cause unorthodox radar vision beyond the geometrical horizon. BOOKER, H. G. *J. Instn Elect. Engrs, Pt IIIA*, **93** (*No.* 1) 69–78 (1946).—[Abstr. 2906 B (1946)].

551.594.6 : 621.396.812 : 621.396.11 3259

The attenuation of centimetre radio waves and the echo intensities resulting from atmospheric phenomena. RYDE, J. W. *J. Instn Elect. Engrs, Pt IIIA*, 93 (*No.* 1) 101–3 (1946).—[Abstr. 2905 B (1946)].

553.621 : 548.53 *see Abstr.* 3236

BIOLOGY 57/59

577.1 : 535.372 *see Abstr.* 3130

578.088.75 : 621.396.616 3260

Nerve stimulator. WEISS, W. I. *Electronics*, **19**, 155 (*Feb.*, 1946).—[Abstr. 2707 B (1946)].

581.141.037 3261

Growth correlates of electromotive forces in maize seeds. NELSON, O. E., JR., AND BURR, H. S. *Proc. Nat. Acad. Sci., Wash.*, **32**, 73–84 (*April* 15, 1946).—For any maize there are two possible potential determinations. The first of these, the prime potential, is apparently highly correlated with seed viability, but with no other measured attribute of plant growth. The second, the equilibrium potential, is not correlated with seed viability but rather with the inherent genetic constitution of a plant, since by use of the potentiometer and equilibrium potential determinations, one is enabled to segregate from a given population those seeds with superior growth characteristics. Further, these potential differences between seeds have been highly correlated with the growth of progeny which were one generation removed. For these reasons, the potentiometer may prove to be a useful tool for plant breeders.

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612.843.37 = 4 3262

Contribution to the study of visual thresholds. WEINSTEIN, C., AND ARNULF, A. *Commun. Lab. Inst. Opt., Paris*, **2**, 1–43 (*March*, 1946) *In French.*—An experimental investigation of limits of visibility of circles against a black background. Circles of brightnesses from 10^{-6} to 10^{-11} stilb and 1′ 20″ to 8° diameter were used. Fixation was on the fovea, and up to 35° away from the fovea. For high brightnesses, area × liminal brightness was constant; near the threshold, the diameter appears independent of brightness. The intermediate region varies greatly between observers. All observers noted that the diameter of a bright circle appeared to decrease as the brightness decreased. N. C.

612.843.37 = 4 3263

Investigation of wavelengths of light which do not destroy dark adaptation. FLAMANT, F. *Commun. Lab. Inst. Opt., Paris*, **2**, 44–6 (*March*, 1946) *In French.*—Description of experiments. Dark adapted observers were subjected to light of varying intensities and wavelengths for a period of 5 minutes, and the time noted which elapsed before the same degree of dark adaptation was reached after the light was turned off. For wavelengths >6 000 Å this time was always small (a few seconds). It is concluded that these wavelengths do not destroy dark adaptation, and that observers may wear suitable goggles while dark adapting and still be able to read or write during the process. N. C.

612.843.63 = 4 3264

Contribution to the study of the Stiles–Crawford effect. FLAMANT, F. *Commun. Lab. Inst. Opt., Paris*, **2**, 47–59 (*March*, 1946) *In French.*—An experimental study of the effect, in which the observer's eye was kept in a fixed position by requiring him to bite on a wax impression. The efficiency of different parts of the pupil was plotted as a function of distance from the centre of the pupil, and for some observers the curve increased monotonically across the pupil, while for others it had a maximum near the middle. Brightnesses ranged from 10^{-3} to 10^{-9} stilb. Readings were taken with free vision, foveal vision, and fixation at various angles up to 18°. A set of readings was also taken with wavelengths of 6 500, 5 250 and 4 500 Å and results similar but not identical to those with white light were obtained. N. C.

616-073.75 = 4 3265

Recording of invisible radiological phenomena, in particular, the pulsation of pulmonary arterioles. Kinedensography. MARCHAL, M. *C.R. Acad. Sci., Paris*, **222**, 973–6 (*April* 15, 1946) *In French.*—A method has been devised for the electrical recording of movements and changes in density of organs of the body made visible by X-ray fluoroscopy. The organ to be examined is viewed first on a fluorescent screen and an X-ray sensitive photoelectric cell is placed in an appropriate position in the X-ray beam. Movements of the organ or changes in its opacity then cause variations in the amount of radiation falling on the cell. These are amplified and recorded by means of a cathode ray oscillograph. Illustrations show the pulsations of the ventricles of the heart, and the hilar branch of the pulmonary artery. The method is sufficiently sensitive to show changes which are invisible on the fluorescent screen. This is illustrated by a record of the pulsations of the terminal branches of the pulmonary artery. J. E. R.

616-073.75 : 778.332 : 771.376.35 *see Abstr.* 3270

666.037.5 3266

Glass-to-metal seal design. SCOTT, W. J. *J. Sci. Instrum.*, **23**, 193–202 (*Sept.*, 1946).—A theoretical discussion of the different metals available for sealing leads through different glasses. The function of the intermediate oxide layer is described. Seals can be divided into 3 basic types; more complex cases are combinations of these. The principles to be followed in choosing a seal for a given purpose are outlined, and some seals in common use described, including glass/metal/terminal seals and glass windows sealed into steel walls. N. C.

669.111 3267

Alpha-gamma transformation in iron-carbon alloys. WRAZEJ, W. J. *Nature, Lond.*, **158**, 308 (*Aug.* 31, 1946).

669.296 3268

Ductile zirconium from zircon sand. KROLL, W. J., SCHLECHTEN, A. W., AND YERKES, L. A. *Trans. Electrochem. Soc.*, **89** (*Prepr. No.* 29) 12 *pp.* (1946).—A process is described for making ductile Zr metal using zircon sand as a starting material. Solid ingots have been made weighing as much as 365 gm and with a Brinell hardness as low as 197. The ingots can be forged and rolled into sheet. The essential steps of the process are: (1) production of carbides from zircon sand; (2) chlorination of the carbides; (3) sublimation of the chlorides; (4) reduction of the chloride with Mg; (5) vacuum distillation of the reaction products; (6) melting the metal in a vacuum arc furnace. The apparatus for the various steps is described, especially the reduction vessel in which $ZrCl_4$ vapour is reduced with Mg.

669.35.725 : 548.734.4 *see Abstr.* 3242

676 : 535.36.2 *see Abstr.* 3126

PHOTOGRAPHY 77

771.351 : 535.8 3269

The performance of aircraft camera lenses. SELWYN, E. W. H., AND TEARLE, J. L. *Proc. Phys. Soc., Lond.*, **58**, 493–525 (*Sept.*, 1946).—For quantitative considerations it is necessary to adopt a measure of the detail-revealing capacity of the negatives, and for this purpose the resolving power was chosen. Careful choice of test-object was necessary, for different test-objects gave different results. A test-object consisting of sets of two rectangles separated by their width, with a difference in density of 0·2 (brightness ratio 1·6 : 1) between them and the background, was adopted. A figure for the performance of any lens was obtained by averaging the resolving power over the field of the lens, having regard to the greater area covered at the larger angles. It could be represented with very fair accuracy by the formula

$$R = \left[\frac{207}{f \,.\, G}\right]^{\frac{1}{2}} \cdot \left[\frac{F \,.\, No.}{\tan^2 \theta}\right]^{0 \cdot 3}$$

where R is the mean resolving power in lines per mm over the field up to an angular distance θ from the axis, f is the focal length of the lens in inches, and $F.\,No.$ its relative aperture. G is the granularity of the film in density-microns at a density of 1·0. This formula has no substantial theoretical basis, although it can be accounted for to some extent.

771.376.35 : 778.332 : 616–073.75 3270

Automatic control for diagnostic X-ray exposures. HILLS, T. H. *Brit. J. Radiol.*, **19**, 288 (*July*, 1946).—Three photo-electric cells, of combined area 48 in^2 and activated by a fluorescent coating, receive the radiation after it has passed through the film cassette. Their current charges a capacitor which strikes a Ne lamp at a predetermined potential value. The relay operates, therefore, to give films with a uniform average density.

771.535 3271

Latent image formation in thallous bromide gelatin systems. RITCHIE, M., AND THOM, J. A. *Trans. Faraday Soc.*, **42**, 418–31 (*May*, 1946).

778.332 : 616–073.75 : 771.376.35 *see Abstr.* 3270

778.534.8 3272

A wide-angle Fastax. WADDELL, J. H. *Bell Lab. Rec.*, **24**, 139–44 (*April*, 1946).—Describes the mechanical and optical changes necessary to redesign a 16 mm Fastax high-speed camera for 35 mm working. This enables relatively wide angle pictures of 40 degrees to be taken using a standard 35 mm focus lens. The frame height is reduced from 0·75 in to 0·375 in, allowing exactly 2 perforations per frame. The drive sprocket on the projector must also be accordingly reduced from 16 to 8 teeth. The reduction in frame height necessitates an increased image speed which maintains the lower rotational speed of the prism. This problem was solved by using a glass of high refractive index in the prism besides slightly increasing the thickness and the length to accommodate the wider film. The new camera is fitted with 2 view finders and a number of control lenses of varying foci are supplied. A novel adaptation of the camera for recording high-speed oscillograph traces after removing the rotating prism is described. P. O.

778.55 : 535.88 = 4 3273

Increased luminous efficiency of cinematograph projectors. MATHIEU, F. C. *Ann. Radioélectricité*, **1**, 256–63 (*Jan.*, 1946) *In French.*—Describes a modification of the mechanism which moves the film in a cinematograph projector. The speed of the finger operating the Maltese cross is not uniform but is a maximum as it disengages, with the result that the angular velocity of the Maltese cross is not symmetrical about its maximum. In consequence of this, it is possible to reduce the angular width of the shutter from slightly over 90° to 60°, and so obtain a 50% increase in the luminous efficiency.

J. W. T. W.

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